HHL LEIPZIG GRADUATE SCHOOL OF MANAGEMENT

Dissertation

(International) Top Managers – Strategic Implications for Innovativeness, Risk and Digital Transformation

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This cumulative dissertation investigates the role and implications of top managers in firms. By building on two influential contemporary phenomena – internationalization and digitalization – and by examining top managers from a multitude of conceptional and methodological angles, the dissertation provides novel insights to upper echelons research. The first study examines the association between top management team (TMT) internationalization and firm innovativeness and argues that the accumulation of international knowledge and resources in the TMT benefits firm innovativeness. The second study analyzes the association between CEO internationalization and firms' strategic risk-taking, paying particular attention to various governance mechanisms that may influence this relationship. The third study explores the role and facilitating actions of top managers in response to the digital transformation. Overall, this dissertation contributes toward a more fine-grained understanding of top managers and their individual characteristics. Given the contemporary relevance of the topics under consideration, the presented findings are of significant value for both theorists and practitioners.

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List of abbreviations

CDO	Chief digital officer
CEO	Chief executive officer
CFO	Chief financial officer
CIO	Chief innovation officer
CTO	Chief technology officer
c.f.	confer (compare with)
CV	Curriculum vitae
DAX	Deutscher Aktienindex
DOI	Digital object identifier
D&O	Directors and officers
EIASM	European Institute for Advanced Studies in Management
EIBA	European International Business Academy
et al.	Et alii (and others)
etc.	et cetera (and so on)
EURAM	European Academy of Management
e.g.	Exempli gratia (for example)
FSTS	Foreign sales to total sales
GCGC	German Corporate Governance Code
HDAX	“Hundert” DAX (formerly DAX100)
i.e.	Id est (that is)

IB	International business
IPDMC	Innovation and Product Development Management Conference
IT	Information technology
MNE	Multinational enterprise
OLS	Ordinary least squares
p.	Page
PCA	Principal component analysis
PwC	PricewaterhouseCoopers
R&D	Research and development
ROA	Return on assets
RQ	Research question
S&P	Standard & Poor's
SIC	Standard industrial classification
TMT	Top management team
VHB	Verband der Hochschullehrer für Betriebswirtschaft
VIF	Variance inflation factor
vs.	versus (as opposed to)

CHAPTER 1

Introduction

"If we want to explain why organizations do the things they do, or, in turn, why they perform the way they do, we must examine the people at the top."

Hambrick, 1989, p.5

Top managers[1] stand at the frontline of their organization. They assume overall responsibility for the firm and have a disproportionate influence on its general set-up and related outcomes. Prominent examples of top managers come to mind when thinking of highly successful corporations: Steve Jobs (Apple), Mark Zuckerberg (Facebook) or Elon Musk (Tesla, SpaceX) – these are just a few examples of top managers that are publicly praised by the media for the success of the firms they (used to) lead (Lovelace et al., 2018). More generally, the public eye often attributes the fate of corporations to those individuals at the top of an organization's hierarchy (Meindl et al., 1985). Top managers are applauded for the good times and come under fire in bad times. This tendency of attributing extreme occurrences to leaders is often referred to as the "romance of leadership" (Meindl et al., 1985). While the public widely accepts that top managers do matter in firms, the *extent* to which they do so remains far less questioned though (Lovelace et al., 2018; Meindl et al., 1985; Quigley & Hambrick, 2015).

Strategic leadership researchers have long sought to obtain an empirical understanding of the role of top managers in firms. As a result of this endeavor, they amassed a large volume of relevant insights about top managers' "characteristics, what they do, how they do it, and particularly, how they affect organizational outcomes" (Finkelstein et al., 2009, p.4). Despite a preceding controversial debate about whether top managers have a traceable impact on firm-level outcomes, research has eventually shifted toward a more in-depth investigation of top managers' latitude of action (i.e., also called managerial discretion) (Wangrow et al., 2015). In line with this notion, Finkelstein et al. (2009) acknowledged that „Considerable research is still needed, not so much on the most basic elements of what managers do and whether they matter, but on *how* and *when* they matter" (p.41). Taking this call for further research on top managers as a basis, the contribution of relevant new insights about top managers lies at the core of this dissertation.

[1] The academic literature often uses the terms 'top managers' and 'executives' synonymously. In addition, various conceptualizations exist regarding who is referred to as top managers/executives. As a matter of consistency, this dissertation employs the term 'top managers.' In line with Finkelstein et al. (2009) and Hambrick (1989), it is defined in this dissertation as the individuals at the top of the corporate hierarchy who have overall responsibility for the firm. The entire group of these individuals is the top management team (TMT). Firms' annual reports usually specify the distinct members of the TMT. The annual reports issued by German stock-listed firms typically refer to their top managers as 'members of the Board of Management/Managing Board.' In the German corporate governance context, boards of management generally consist of a chairperson or spokesperson (i.e., CEO; 'Vorstandsvorsitzender' in German) and other board members with distinct responsibilities for specified functions or geographies.

Underlying strategic leadership research is the basic assumption that major organizational choices are made by human beings, whose behaviors and choices are defined by their idiosyncratic experiences, personalities, values, aspirations, and dispositions (Hambrick & Mason, 1984; Kahneman & Tversky, 1982; Thompson, 1967). These unique characteristics introduce differences in how top managers perceive and interpret their surroundings and eventually act upon these cues (Carpenter et al., 2004; Hambrick, 2007). Because the strategic decision-making context top managers are confronted with is typically defined by a large volume of ambiguous and complex information, it is highly unlikely that top managers assess and act upon the same situation in the exact same way (Hambrick, 1989). Consequently, as prominently titled by Hambrick and Mason (1984), "the organization [becomes] a reflection of its top managers." While this statement may initially appear as glorifying top managers, it is rather meant to emphasize the human limitations (i.e., biases, filters, aspirations, etc.) that underlie top managers' choices and behavior in firms (Hambrick, 2007). By neglecting the focus on upper echelons, strategic management theory would miss an essential element, because top managers have a disproportionate influence on the set-up and outcomes of their firms (Finkelstein et al., 2009).

1.1 Scope of the dissertation and research gaps

This dissertation aims at advancing our empirical understanding of top managers by building on two current phenomena that transform not only the business landscape but also our everyday lives: internationalization and digitalization[2]. Given the far-reaching impact that these developments have, top managers are naturally confronted as well. As a result, fruitful contexts for comprehensive scientific analyses emerge that may provide novel and contemporary insights on the antecedents and consequences of firms' upper echelons.

Internationalization

The business world is becoming increasingly international, altering the nature and boundaries of strategy as well as competition (Bartlett & Ghoshal, 2007; Porter, 1986; Sanders & Carpenter, 1998). Nowadays, it is rather the rule than the exception that firms expand their business activities beyond domestic confines, and seize opportunities available in global markets. For example, a study from professional services firm PwC (2017) reports that the industrial firms listed on the German DAX30 index generate almost 80% of their revenues

[2] Various terms exist to capture the impact that digital resources have on firms (i.e., 'digitization,' 'digitalization,' and 'digital transformation'). While subtle differences exist concerning the terms' meanings, the terms are used interchangeably in this dissertation. In this way, it matches the German language and business context, in which the use of a more fine-grained definition has been largely neglected (Staudt, 2019).

abroad. Despite the advantages that global markets promise, doing business across borders involves complexity stemming from dissimilar business contexts as well as higher coordination costs (Hutzschenreuter et al., 2016; Prahalad, 1990; Sanders & Carpenter, 1998). Against this background, scholars suggest that firms' intensifying international involvement should be accompanied by top management teams (TMTs) that possess the cognitive capacity and transnational skills to deal with the complex demands inherent in global markets (Adler & Bartholomew, 1992; Carpenter & Fredrickson, 2001; P. Greve et al., 2009; Kaczmarek & Ruigrok, 2013). In line with this notion, firms have increasingly tried to add internationally seasoned individuals to their TMTs (Hartmann, 2015; Rivas, 2012). Indeed, according to a study by consulting firm Simon-Kucher & Partners (2019), the share of foreign nationals in TMTs of the DAX30 corporations has reached an all-time high of 35.4%. Additionally, Hartmann (2015) claims that in the 100 largest German corporations, almost every other top manager has international experience of at least six months.

Following the growing internationalization of firms and their TMTs, scholars have sought to develop an empirical understanding of the antecedents and firm-level consequences of international top managers. In this context, related research has primarily drawn upon upper echelons theory (Hambrick & Mason, 1984). The theory formally suggests that the choices of top managers are defined by their individual experiences, values, and personality, which, in turn, are mirrored in firm strategies and performance. To proxy for top managers' cognitive frames, researchers have widely relied on a diverse set of demographic characteristics (e.g., age, functional background, and education) (Carpenter et al., 2004; Hambrick, 2007). Although scholarly attention has been growing, the internationalization of TMTs remains a relatively understudied facet within upper echelons research (Finkelstein et al., 2009). Existing studies associated international top managers, in particular, with international diversification strategies (e.g., Herrmann & Datta, 2005, 2006) or performance outcomes (e.g., Daily et al., 2000; Dauth et al., 2017). Underlying these studies rests the argument that international exposure significantly affects top managers' cognition and subsequent choices.

To advance our theoretical understanding of the implications that the growing prevalence of internationally experienced top managers entails, two scientific articles included in this dissertation investigate the associations of international top managers with two highly relevant outcomes in firms. **Article 1** examines *the association between international TMTs and firm innovativeness* and places a particular focus on international top managers' unique human and social capital, which may benefit innovativeness. **Article 2** investigates *whether international chief executive officers (CEOs) are associated with higher levels of strategic*

risk-taking of their firms. To this end, the article pays particular attention to international top managers' risk perception as well as confidence. Although both subjects represent critical topics for firms, an empirical understanding of the relationships under consideration used to be absent. The presented research articles fill this gap.

Digitalization

The second development that this dissertation builds on is digitalization. Beginning with the broad dissemination of new digital technologies, such as the internet, cryptocurrencies, or smartphones, the digital revolution has significantly changed the way business is done. New players with innovative digital ideas, as well as changing customer expectations and behaviors, challenge established business models that used to be successful for many years (Verhoef et al., 2019). Within only 15 years, digital giants like Apple, Alphabet, Amazon, and Facebook have replaced General Electric, Exxon Mobil, Citigroup, and Walmart as the most valuable firms on the S&P500 index (ETF Database, 2004; Siblis Research, 2019). Inside of firms, digital technologies trigger changes in production modes and alter the way in which employees work and collaborate (Schwarzmüller et al., 2018). In order to remain competitive in the long-run and to ensure survival, it is vital for firms to adapt to these changing conditions (Verhoef et al., 2019). Consequently, top managers – in their role as firms' key decision-makers – find themselves confronted with new and unprecedented challenges.

When taking a deeper look at the academic literature, it becomes evident that top managers have rarely been associated with digital aspects. Although many studies highlight that TMT support is crucial for a firm's digital transformation (de la Boutetière et al., 2018; Matt et al., 2015), our empirical understanding of the actual role of top managers in this context is fairly limited. The few studies that investigated direct relationships between top managers and digitalization aspects focused in particular on digitalization-specific roles within the TMT (Horlacher & Hess, 2016; Medcof, 2008; Singh & Hess, 2017) or the nature of leadership (Cortellazzo et al., 2019; Schwarzmüller et al., 2018).

The purpose of **Article 3** of this dissertation is to explore and contribute novel and relevant insights about the *specific role as well as practices of top managers in firms' digital transformation*. By addressing an important gap in the literature, this article builds an initial theoretical basis, which may serve as a starting point for the further investigation of top managers across various academic disciplines.

Overall, the scientific articles presented in this dissertation contribute toward a more refined understanding of the firm-level implications of TMTs and their individual characteristics. By investigating top managers in the context of contemporary phenomena that have a significant impact on businesses today and in the future, the presented findings are of significant value not only for theorists but also for practitioners. Further details about the respective research articles and their specific contributions are presented in the following sections. The next section aims to establish the empirical foundation, which underlies and, at the same time, unifies the articles presented in this dissertation. All three articles are grounded in strategic leadership research. In a narrower sense, articles 1 and 2, which concentrate on the international profiles of top managers, particularly draw on insights surrounding upper echelons theory. A detailed overview of the different articles is presented in section 1.4.

1.2 Theoretical foundation

1.2.1 A brief history of research on top managers

The academic attention to top managers is not a new phenomenon, but it has varied considerably over the past 80 years (Finkelstein et al., 2009). Until the 1970s, key theories of organization and strategy acknowledged the central role that top managers play in firms (cf. Barnard, 1938; Selznick, 1957; Chandler, 1962; Andrews, 1971). Then, the scholarly interest in the "human factor" in organizations widely paused as comparatively mechanical models took center stage (Finkelstein et al., 2009). Instead of regarding the fate of organizations as the result of decision-makers' strategic choices, these newer perspectives on organizations emphasized the dependence on "non-human" determinants, such as contextual imperatives (i.e., determinism; e.g., Blau, 1970), random or historically contingent occurrences (i.e., population ecology; Hannan & Freeman, 1977), or pressure to conform (i.e., new institutional theory; e.g., DiMaggio & Powell, 1983). Strategic management research placed a dominant focus on frameworks to quantify and succinctly depict strategic issues, such as competitor and industry analysis (e.g., Porter, 1980).

The revival of scholarly interest in top managers slowly developed in parallel. Having been dissatisfied with the deterministic focus of organization researchers, Child (1972) claimed that these lines of research miss the immediate origin of organizational differences, which are the decision-makers who have the power to initiate significant changes in the organizational set-up. In an attempt to specify these decision-makers, the author refers to Cyert and March's (1963) concept of the 'dominant coalition,' which can be any group of individuals in a firm that exercises strategic choices. The breakthrough in research on top managers came in the early

1980s when Hambrick and Mason (1984) published their seminal article that established the formal groundwork for the 'upper echelons perspective' (Carpenter et al., 2004; Finkelstein et al., 2009). Besides other influential articles emerging at the same time (e.g., Gupta & Govindarajan, 1984; D. Miller et al., 1982), research on top managers eventually began to flourish. Ever since, hundreds of articles, books, and other written pieces on top managers and their organizations have accumulated. Still, there are no indications that the scholarly interest in top managers is waning (Carpenter et al., 2004; Hambrick, 2007).

1.2.2 Top managers' influence on firm-level outcomes

As emphasized in this brief historical recap, the literature has brought forward contrasting perspectives on the relevance of top managers in firms. On the one hand, scholars claim that top managers play a key role in determining a firm's form and fate; on the other hand, it is argued that top managers are significantly limited in their choices by environmental, normative, and inertial constraints. To bridge these polar views, Hambrick and Finkelstein (1987) introduced the concept of 'managerial discretion,' which describes the latitude of action that decision-makers have in a given situation. According to this concept, the actual magnitude of managerial discretion available to a top manager is dependent on "the task environment, internal organizational factors, and managerial characteristics" (Wangrow et al., 2015, p. 102). Similar to the early debate about whether top managers matter for organizational outcomes, the effect size of top managers' latitude of action has been controversially discussed. Whereas some studies estimate the variance in different outcome variables attributable to top managers to account for only 5 to 20 percent (e.g., Bertrand & Schoar, 2003; Crossland & Hambrick, 2011; Lieberson & O'Connor, 1972), more optimistic studies suggest that the managerial impact on organizations is much more substantial (Hambrick, 2007; Hambrick & Quigley, 2014; Weiner & Mahoney, 1981). A recent study by Quigley and Hambrick (2015) even claims that the influence of CEOs in firms is growing, which reemphasizes that gaining a broader understanding about *how* top managers, and CEOs in particular, influence firm-level outcomes is becoming increasingly relevant.

Overall, no matter *how much* latitude of action is attributed to top managers by econometric models, the basic tenor in management research has settled on the assumption that top managers do matter – however, at varying degrees (Crossland & Hambrick, 2011; Finkelstein et al., 2009; Hambrick, 2007; Hambrick & Abrahamson, 1995). To arrive at more precise judgments about the impact of top managers in firms, environmental, organizational, and individual managerial factors need to be considered (Hambrick & Finkelstein, 1987; Wangrow et al., 2015).

1.2.3 Top managers' characteristics

In contrast to the widely held assumption in classic economic theories that decision-makers act rationally (Cook & Levi, 1990), a vast volume of research and everyday observation suggests differently. In addition to academic research, popular psychologists and bestseller authors such as Amos Kahneman (*Thinking, fast and slow*; 2011) or Dan Ariely (*Predictably irrational*; 2010) have brought the science of human cognition to the mainstream population, sharpening our eye for the cognitive biases and heuristics that implicitly manipulate our thinking, choices and actions. What these authors' works emphasize is that decision-making is highly individual and dependent on our own constructions of reality. Each individual sees the world through his/her own lens, which, in turn, is shaped by one's experiences, values, personality, social context, and many other influencing factors. Correspondingly, as collectives of human decision-makers, these tendencies are highly applicable in organizations as well. To build an understanding of why organizations act or perform as they do, it is therefore vital to "consider the biases and dispositions of their most powerful actors – their top executives" (Hambrick, 2007, p.334).

Capturing the subjectivity in managerial judgment, Hambrick and Mason (1984) laid the theoretical foundation for the **upper echelons perspective** in their seminal article titled "*Upper echelons: The organization as a reflection of its top managers*." Grounded in the behavioral theory of the firm (Cyert & March, 1963), upper echelons theory states that the strategic choices and performance levels of organizations are partially predicted by the individual background characteristics of its top managers (Hambrick & Mason, 1984). At the core of this prediction lies the assumption that top managers' choices are subject to "bounded rationality, multiple and conflicting goals, myriad options, and varying aspiration levels" (Hambrick & Mason, 1984, p. 194). These contingencies limit top managers' ability to make fully informed, rational and optimal decisions (Cyert & March, 1963; March & Simon, 1958). Consequently, this restraining effect is particularly pronounced in environments involving high levels of uncertainty and ambiguity as well as information overload, such as when top managers need to make complex and important strategic choices for their firms (Finkelstein et al., 2009; Hambrick, 2007; Hambrick & Mason, 1984). Because these situations are not objectively comprehensible but require interpretation, the eventual decisions carry the imprint of top managers' experiences, knowledge, personality, values, and other human characteristics (March & Simon, 1958; Mischel, 1977). More formally, this individual set of "givens" reflects the top manager's cognitive base (i.e., knowledge or assumptions about future events, knowledge of alternatives, and knowledge of consequences attached to alternatives) as well as his or her values (i.e., principles for ordering alternatives according to preference)

(Hambrick & Mason, 1984). In situations when top managers are being confronted with multiple potential stimuli inside and outside of the firm, the cognitive base and values act as filters and distort the top managers' perceptions.

To illustrate the cognitive process leading to top managers' strategic choices, Hambrick and Mason (1984, p.195) present a sequential model that builds the core of the upper echelons theory. At the beginning stands an objective situation that the top manager, or an entire TMT, is exposed to. Since strategic situations are complex and involve many more stimuli than he/she can possibly grasp, the top manager's cognitive base and values determine and constrain the set of phenomena that are perceived and subsequently considered in strategic choices. Underlying this selection process of final items that enter the top manager's perception is a three-step filtering mechanism. First, the large volume of all potential environmental and organizational stimuli is sharply reduced by the attention that the top manager directs to certain areas (i.e., *limited field of vision*). Second, the set of stimuli appearing in the field of vision is further condensed to the ones that he or she can actually perceive (i.e., *selective perception*). Finally, meaning is attached to the remaining pieces of information based on the top manager's cognitive base and values (i.e., *interpretation*). The strategic choice is ultimately made on the basis of the top manager's perception of the situation as well as his or her values.

Since the values, beliefs, and cognitions of individuals are difficult to measure and quantify (Pfeffer, 1983), upper echelons theory proposes to rely on top managers' observable (demographic) characteristics (e.g., age, education, or prior experiences) as valid proxies (Hambrick & Mason, 1984). Although this approach falls short of reaching the comprehensiveness and precision of sophisticated psychological assessments or real-life observations, it still allows for generating valid insights in areas that would otherwise remain hidden or at least barely covered (Hambrick, 2007). For example, by relying on observable characteristics, the often-cited difficulty of winning a sufficient number of top managers that are willing to participate in psychometric studies can – at least to some extent – be counterbalanced. In general, the vast amount of studies that found significant relationships between top managers' demographic backgrounds (both individual top managers and TMTs) and organizational outcomes lends empirical support for the validity of this approach (Carpenter et al., 2004; Finkelstein et al., 2009; Hambrick, 2007).

Up until today, upper echelons scholars have investigated a wide array of managerial background characteristics. The most studied characteristics include top managers' functional

background (e.g., finance, operations, marketing), formal education, tenure or international experience (Finkelstein et al., 2009; B. B. Nielsen & Nielsen, 2011). Many other characteristics have attracted scholarly interest as well and contributed toward a more nuanced understanding of the link between top managers' backgrounds and organizational outcomes. For example, more recent studies were interested in managerial characteristics such as experience variety (Crossland et al., 2014; Georgakakis et al., 2016; Mingxiang Li & Patel, 2019), gender (Dezsö & Ross, 2012; Lyngsie & Foss, 2016; Perryman et al., 2016), social class background (Kish-Gephart & Tochman Campbell, 2015) or birth order (Campbell et al., 2019).

At the TMT level, the scholarly discussion has particularly revolved around heterogeneity constructs, such as diversity in the TMT members' functional or educational backgrounds, age, or tenure (for a comprehensive review, see S. Nielsen, 2010a). In order to obtain a more precise grasp of the internal procedures within TMTs, more recent studies have begun to consider intra-TMT power distributions as well as TMTs' behavioral integration (i.e., the degree to which a TMT acts collaboratively as a team instead of as a group of independent individuals) (Hambrick, 2007). By taking a closer look at team-internal aspects, these studies partly address the so-called 'black box problem,' which describes the inability of demographic indicators to capture the actual mechanisms (e.g., team processes and cognitive diversity in TMTs) that lie between top managers and organizational outcomes (Lawrence, 1997; Priem et al., 1999).

1.2.4 Top management team internationalization

The internationalization of TMTs has received increasing attention in upper echelons research over the past two decades (Finkelstein et al., 2009). This development aligns with the growing presence of internationally seasoned top managers in upper echelons, as firms try to match top managers' profiles with the strategic demands posed by the international environment they operate in (P. Greve et al., 2009; Kunisch et al., 2019; Simon-Kucher & Partners, 2019). The internationalization of TMTs mainly occurs through the addition of members with 1) a foreign nationality, and/or 2) relevant international experience (B. B. Nielsen & Nielsen, 2011). The basic argument in favor of this development is that internationally experienced individuals have a deeper understanding about foreign markets and business practices, transnational skills, as well as greater awareness of international business opportunities (Adler & Bartholomew, 1992; Carpenter et al., 2000; Tihanyi et al., 2000). This enhanced global understanding – or "global mindset" (Adler, 2002; Javidan & Bowen, 2013) – enables top managers to approach issues with a broader perspective in mind (i.e., local and global conditions) and to better cope with the significant complexity that a firm's involvement in

global markets entails (Carpenter et al., 2001; Sanders & Carpenter, 1998). Accordingly, international top managers bring valuable human and social capital to global firms (Carpenter et al., 2000, 2001; Daily et al., 2000).

Numerous ways exist in which top managers may gain critical international exposure and experience. The most intensive experience occurs when living in a foreign country, for example, when growing up in a foreign country or when spending shorter or longer periods abroad for education or professional assignments (Maddux & Galinsky, 2009). During these periods, top managers may develop a deeper cultural understanding, obtain critical market knowledge, and build personal and professional global networks (Adler & Bartholomew, 1992; Carpenter et al., 2001; Norris & Gillespie, 2009; Sambharya, 1996). Also, short stints abroad, such as business trips, represent another option for top managers to learn about foreign business contexts and to build awareness (Athanassiou & Nigh, 2002; Baruch et al., 2013). In addition to these direct forms of exposure, other more indirect opportunities for building a greater understanding about foreign countries include the proficiency of another language (Piekkari & Tietze, 2011), or the interaction and/or collaboration with foreign clients, business partners or colleagues (e.g., in a foreign subsidiary) while still being based in the home country (Athanassiou & Nigh, 2002).

To investigate the relationship between internationally seasoned top managers and firm-level outcomes, researchers have relied on various definitions and measurement approaches to capture top managers' international profile. The two most commonly applied indicators are a top manager's nationality as well as various kinds of international experiences, such as international assignment experience, international work experience, or international education (for a review of top managers' internationalization measures see Schmid and Dauth (2014)). While earlier studies mainly relied on single-dimension measures (e.g., Sambharya, 1996; Staples, 2007), more recent ones attempt to capture the multifaceted nature of internationalization and apply constructs that integrate multiple elements reflecting an individual's international profile (e.g., Dauth et al., 2017; S. Nielsen, 2010b; Oxelheim et al., 2013; Schmid & Dauth, 2014). For example, multiple studies (e.g., Schmid & Daniel, 2006; Schmid & Dauth, 2012, 2014; Schmid & Wurster, 2016) employ a four-component index that aims to capture the life and career stages in which an individual obtained critical international experience and knowledge (cf., Carpenter & Westphal, 2001; Dickmann & Harris, 2005; Hambrick et al., 1998; Norris & Gillespie, 2009). The internationalization components included are: (a) nationality, (b) international education, (c) international work experience, and (d) international board appointments. Following the tendency toward more

comprehensive measures to capture top managers' internationalization, articles 1 and 2 of this dissertation apply this index as well.

Overall, several empirical studies find support for the notion that international top managers not only influence strategic choices, but they may also benefit performance (e.g., Carpenter et al., 2000; Dauth et al., 2017; S. Nielsen, 2010b). For example, prior research found that international top managers and TMTs are more attuned to international strategies. These tendencies are reflected, for instance, in firms' higher levels of international diversification (Herrmann, 2002; Herrmann & Datta, 2005; Sambharya, 1996; Tihanyi et al., 2000) as well as greater propensities to form international alliances (Lee & Park, 2008) and international strategic partnerships (Reuber & Fischer, 1997). Moreover, existing research identified significant associations between international top managers/TMTs and enhanced performance, for example, in terms of overall firm performance (Carpenter et al., 2001; Daily et al., 2000; B. B. Nielsen & Nielsen, 2013) or financial reporting quality (Dauth et al., 2017). Other studies, however, found inconclusive results (e.g., Roth, 1995), which leaves the question open whether and to what extent international top managers truly add value to firms (Schmid & Dauth, 2014). Given the increasing presence of internationally seasoned top managers in upper echelons as well as associated performance benefits for firms, gaining a deeper understanding of this relatively under-researched topic is of pronounced value for both theory and practice. By investigating associations with firm innovativeness and strategic risk-taking, articles 1 and 2 contribute novel insights to this line of research.

1.3 Empirical foundation

This dissertation builds on two separate sets of data that are the result of extensive data collection efforts throughout my doctorate. While articles 1 and 2 rely on quantitative data, article 3 is based on qualitative data. In order to match the distinct data characteristics, different empirical approaches are used to analyze the data.

1.3.1 Quantitative analysis

Sample

The sample for the dataset employed by articles 1 and 2 is based on large firms listed on the German HDAX index. The HDAX incorporates the most liquid and largest firms traded in the prime-standard segment of the Frankfurt Stock Exchange (STOXX Ltd., 2016). Although smaller firms might be more willing to provide in-depth insights into their internal procedures, the rationale behind favoring these large stock-listed firms is that they are

required to report on their activities and financial situations. Accordingly, reliable data on these firms is publicly available and conveniently serves the research purposes of articles 1 and 2. The initial sample is based on the 110 firms that were listed on the HDAX index in June 2016. The final sample emerged from a systematic elimination procedure. From the initial 110 firms, 16 firms that were mainly active in broad industry categories considered to be less research-intensive (i.e., banking, insurance, real estate, and retail industries) were removed to match the scope of the research projects. Following the same rationale, 15 firms were then eliminated that were not active in research-intensive industries according to the first digit of the SIC classification (i.e., *SIC ≠ 2, 3, 4*). Finally, 23 additional firms were removed with incomplete data profiles (i.e., top manager profiles and firm information). Overall, the elimination process resulted in a final sample comprising 56 firms.

Data collection and key characteristics

The total dataset comprises data covering a period from 2008 to 2017. While firm-specific data was collected for all years along this timespan, the corresponding TMT data was collected for the years 2011 to 2015. In this way, historical data and time lags can be included when matching and analyzing both TMT and firm-level data. In order to accumulate relevant data, various data sources were drawn upon. First, the firms' TMT compositions for the years 2011-2015 were identified using annual reports. After having identified the top managers serving on the respective TMTs, detailed profiles were created for each top manager in a firm in a specific year[3]. The individual profiles each list demographic information (e.g., year of birth, nationality, gender, and organizational tenure) as well as international experiences (incl. their corresponding durations and countries). Corresponding data was derived from company websites, annual reports, or personal profiles online (e.g., from online career networks like LinkedIn and Xing). The profile data of all top managers was eventually compiled in a summarizing spreadsheet. Based on this individual-level data, various TMT-level variables, such as the TMT internationalization index or TMT diversity variables, were calculated. Finally, the individual- and TMT-level data was merged with firm-specific indicators that were retrieved from the database Thomson ONE Banker. In a few cases, some firm data was missing in the database. To close these gaps, the missing data was derived from annual reports and related variables were partially calculated on a manual basis. The final database includes data on 359 different top managers as well as 1270 distinct top manager profiles (i.e., top manager profiles in a given year), thereof 279 CEOs.

[3] I would like to thank Hans Christian Busch for helping me gather relevant data on top managers in the very early stages of the data collection process.

Data analysis

For the analysis of the data, two different methods were applied. To examine the association between TMT internationalization and firm innovativeness, pooled ordinary least squares (OLS) regressions with clustered standard errors were employed. The association between CEO internationalization and strategic risk-taking was analyzed via panel data analysis that relied on a fixed effects estimator. Various supplementary tests were carried out to check the robustness of the empirical findings. All statistical analyses were performed using Stata.

1.3.2 Qualitative analysis

Sample

Given the exploratory nature of research article 3, the sample selection for the empirical analysis followed a much looser approach compared to articles 1 and 2. Several key criteria had to be fulfilled for firms to be included in the sample. Firms had to 1) be located in Germany, 2) be listed on the stock exchange, 3) have at least 500 employees, and 4) be at least ten years old. To select firms and ensure that they would be able to provide relevant insights about their digitalization efforts, purposive sampling (Patton, 2015) was employed. The resultant sample includes 27 firms from a diverse array of industries, including aviation, automotive, chemicals, conglomerate, consumer electronics, energy, fast-moving consumer goods, insurance, logistics, mechanical engineering, media, pharmaceuticals, retail, software, and telecommunications. Furthermore, the size of the sample firms varies considerably from 800 to 650.000 employees. By having such large variations in the sample, a broader understanding of the digital transformation in large German firms can be obtained.

Data collection and key characteristics

In order to obtain relevant and comprehensive insights about the role and practices of top managers in firms' digital transformations, in-depth interviews were carried out with top managers directly or with close associates[4]. The interviews were completed in Fall 2019 in person or via phone and followed a semi-structured interview guideline. The audio recordings of the interviews were carefully transcribed, serving as the basis for subsequent analyses. The final dataset includes rich data material from 27 interviews.

[4] I would like to thank Delia Vossen and Alexandra Späth, whom I supervised throughout the development of their Master's theses, for their great support in conducting and transcribing the majority of the interviews for this research project.

Data analysis

The qualitative data analysis followed an iterative process, applying principles of grounded theory and the Gioia methodology. ATLAS.ti software assisted in organizing and coding the vast amount of data.

1.4 Research purpose and scientific contribution

The centerpiece of this cumulative dissertation consists of three scientific articles that are grounded in strategic leadership research. Inspired by the inconclusive debate regarding how and when top managers matter in firms (Finkelstein et al., 2009), the articles contribute, in a broader sense, toward a more fine-grained understanding of the role and firm-level implications of top managers. The following overview (Table 1) illustrates the different research articles and their respective key characteristics from a content perspective. Table 2 provides several formal details, such as the articles' publication status as well as my personal contributions. Summaries of the different research articles are contained in sections 1.4.1, 1.4.2, and 1.4.3.

Table 1: Key characteristics of the different research articles

		Research article 1	**Research article 2**	**Research article 3**
Scope	***Research question***	Whether and how is TMT internationalization associated with firm innovativeness?	Whether and how is CEO internationalization associated with firms' strategic risk-taking?	How do top managers respond to and facilitate the firm's digital transformation?
	Theoretical focus	Upper echelons theory		Strategic leadership / strategic management
	Unit of analysis	Top management teams	CEO	Individual top managers
	Top manager focus	Internationalization of top managers		General role and practices
	Firm-level implication	Innovativeness	Strategic risk-taking	Digital transformation
Methodology	***Purpose***	Explanatory		Exploratory
	Research design	Quantitative		Qualitative
	Data type	Secondary		Primary (expert interviews)

Overall, this dissertation contributes to top management research by examining the implications of top managers and their background characteristics from a multitude of conceptual and methodological angles. This varied perspective nurtures the development of a more detailed understanding of top managers. At the same time, it underlines the richness and complexity surrounding the study of top managers in organizations. Given the contemporary relevance of the topics covered in the different research articles, the generated insights may be of interest not only for theorists but also for a broader audience of practitioners.

The common basis of all research articles in this dissertation is the general interest in the firm-level implications of top managers. Building on this common ground, each article takes a different thematic focus. Articles 1 and 2 particularly concentrate on international top managers and their associations with 1) firm innovativeness, and 2) strategic risk-taking. By drawing on insights from prior research about international top managers, these articles derive hypotheses that are tested using quantitative methods. In contrast to these studies, article 3 takes a much broader stance as it focuses on top managers in general and explores the role and practices of top managers in the context of digital transformation. To this end, relevant insights are collected via comprehensive expert interviews. The results of the data analysis are presented in a summarizing framework following the Gioia methodology. Despite its different research approach, article 3 is interrelated with the other articles beyond their shared focus on top managers, in that innovation and risk lie at the core of the digital transformation. Articles 1 and 2 thus informed and provided relevant insights that were integrated into article 3.

On a more general level, several other aspects are worth mentioning that highlight the breadth covered by this dissertation. First, this dissertation analyzes top managers from various angles, regarding them as separate individuals (i.e., top managers in general and CEOs) and as a coherent team (i.e., TMT). In addition to investigating the firm-level effects of these distinct units of analysis in separation, cross-level interactions (i.e., interfaces between the CEO, the CFO, and other TMT members) are considered as well. By assuming such a varied perspective on top managers, this dissertation, in its entirety, counterbalances the still unresolved debate in upper echelons research about which unit of analysis (i.e., individual top managers vs. TMTs) constitutes the most meaningful entity to study (Finkelstein et al., 2009; Hambrick, 2007). Second, this dissertation provides relevant insights to two key questions in top management research: What drives top managers' decision-making? And, what are the implications of top managers' decisions? By analyzing top managers' cognition as well as

concrete actions, this dissertation advances our understanding of both antecedents and consequences of managerial decision-making. Finally, by combining explanatory and exploratory elements, this dissertation not only extends prior research lines but it also opens up new paths for further development.

Formal details about the different scientific articles are depicted in the following table.

Table 2: Overview of personal contributions, co-authors, conference presentations, and publication status

	Research article 1 *A temporal perspective on the relationship between top management team internationalization and firms' innovativeness*	**Research article 2** *"Of course, I can": The association between CEO internationalization and firms' strategic risk-taking*	**Research article 3** *Top managers in the digital age: Exploring the role and practices of top managers in firms' digital transformation*
Joint work with	Tobias Dauth	Erik Hille Tobias Dauth	Vivek K. Velamuri Tobias Dauth
Contribution	Main authorship Main responsibility for research design, literature review, data collection, estimations, data analysis, interpretation of results, writing, and publication process	Main authorship Main responsibility for research design, literature review, and data collection Shared responsibility for data analysis, interpretation of results, writing and publication process	Main authorship Main responsibility for research design, literature review, data collection, data coding and analysis, interpretation of results, writing, and publication process
Conference presentation	EURAM 2018 - European Academy of Management Conference, Reykjavik, Iceland IPDMC 2018 – Innovation and Product Development Management Conference, Porto, Portugal (accepted for presentation)	EIBA 2019 – European International Business Academy Conference, Leeds, United Kingdom Vaasa Conference on International Business 2019, Vaasa, Finland	EURAM 2020 - European Academy of Management Conference, Dublin, Ireland (accepted for presentation; conference postponed to Dec'20)

Table 2: Overview of personal contributions, co-authors, conference presentations, and publication status (continued)

	EIASM TMT Workshop on Top Management Teams and Business Strategy 2018, Geneva, Switzerland Joint research colloquium[5] 2017, Stuttgart, Germany EIASM TMT Workshop on Top Management Teams and Business Strategy 2017, Seville, Spain (accepted for presentation) EIBA 2016 – European International Business Academy Conference, Vienna, Austria	Joint research colloquium[5] 2019, Kiel, Germany[6] EIASM Workshop on Top Management Teams and Business Strategy 2019, Passau, Germany Joint research colloquium[5] 2018, Leipzig, Germany	
Publication status	Published in: *Managerial and Decision Economics* (VHB-JOURQUAL3 2015: B) DOI: 10.1002/mde.3119	Revise & resubmit at: *European Management Journal* (VHB-JOURQUAL3 2015: B)	Published in: *Managerial and Decision Economics* (VHB-JOURQUAL3 2015: B) DOI: 10.1002/mde.3202

In the following sections, summaries of the three scientific articles are presented that outline the different articles' motivation and research objectives, methodological approach, as well as key findings and implications.

[5] The joint research colloquium is a yearly colloquium held by ESCP Berlin, TU Dresden, Kiel University (CAU), University of Stuttgart and HHL, which gives doctoral students the opportunity to present and discuss their research projects.

[6] In contrast to previous colloquia, the presentations given by doctoral students were graded at this colloquium by the hosting university (Prof. Dr. Dr. h.c. Joachim Wolf). My presentation received the grade 1.3.

1.4.1 Summary of the first manuscript

A temporal perspective on the relationship between top management team internationalization and firms' innovativeness

Background & research objectives

Despite the growing presence of internationally seasoned individuals on management boards and an increasing interest in top managers by academia, our empirical understanding of the implications of the internationalization of upper echelons is far from complete (S. Nielsen, 2010b). This research article aims to contribute relevant insights to the international business and innovation literature. Additionally, it responds to two contemporary developments in business: first, TMTs are becoming increasingly international (Hartmann, 2015); second, global competitive forces put pressure on firms' innovativeness (Prasad & Junni, 2017). While international TMTs are considered to possess unique human and social capital that may add considerable value to multinational firms, it remained unclear whether international TMTs also benefit firm innovativeness. To address this gap in the literature, this article sheds a theoretical light on whether and how TMT internationalization is associated with firm innovativeness.

Combining upper echelons theory with innovation literature, we argue that international top managers are more innovative for three main reasons: 1) International top managers have a broad perspective on a firm's business context, 2) they are more risk-seeking, and 3) they can draw on a global network. These individual characteristics build a rich pool of different kinds of knowledge, capabilities, and perspectives when aggregated at the TMT-level, which may act as a hotbed for novel creations and innovativeness. In line with this notion, this article focuses on the accumulation of resources instead of the diversity within TMTs, a subject that has already been intensively studied. To reflect the notion that the passage of time affects individuals, team dynamics as well as the accumulation and transfer of knowledge, resources and capabilities (Peteraf, 1993), we also consider contextual factors that follow a "time theme" (i.e., the CEO's age, the average tenure of the TMT members, and firm age). Several hypotheses are derived for empirical testing.

Methodological approach

The hypotheses were tested using a subset[7] of the dataset described in section 1.3.1. The employed sample comprises 56 firms, 280 firm-year observations, and demographic information on 358 different TMT members (i.e., 768 "profile-years"). To capture the internationalization of the TMT, we employed the four-dimensional index of Schmid and Daniel (2006) (please see section 1.2.4 for more details). Firm innovativeness was operationalized via R&D intensity (i.e., R&D expenditure divided by total sales), which is a common proxy for innovativeness (Richard Adams et al., 2006; Daellenbach & McCarthy, 1999). The dataset was analyzed using pooled OLS regressions, with standard errors clustered at two dimensions: firm and year.

Key findings & implications

The results of the statistical analysis indicate that TMT internationalization has the potential to influence a firm's innovativeness positively. This finding lends support to the notion that TMTs comprising both nationals and non-nationals, as well as individuals with international experience, benefit from a much broader resource base than homogeneous TMTs that are limited to domestic grounds. The empirical analysis also suggests that more elderly CEOs attenuate the gains in firm innovativeness introduced by international TMTs. No significant effects are found for the moderator variables TMT tenure and firm age.

Overall, this article advances upper echelons research by refining the field's core tenet that TMTs influence firm-level outcomes (Hambrick & Mason, 1984). By investigating the association between TMT internationalization and firm innovativeness, this study sheds light on the firm-level implications of a relatively under-researched TMT characteristic. Furthermore, it points to the potential benefits (e.g., enhanced firm innovativeness) that international TMTs may bring to organizations. In addition to closing a gap in the literature, this knowledge is also of particular practical value, as it helps firms to develop a better understanding of the implications related to the growing internationalization of TMTs. At the same time, it sensitizes firms about related opportunities, which, in the pursuit of leveraging these opportunities, may trigger adjustments regarding the firms' human resource practices (e.g., recruiting international top managers and/or promoting international assignments as a means to foster top managers' international human and social capital).

[7] The dataset presented in section 1.3.1 is the outcome of a lengthy data collection effort. New data and variables were continuously added throughout this data collection process. The dataset used for the estimations in article 1 represents an earlier version of the final dataset.

1.4.2 Summary of the second manuscript

"Of course, I can": The association between CEO internationalization and firms' strategic risk-taking

Background & research objectives

In today's business environment, top managers are ever more confronted with decision-making under uncertainty – a phenomenon that is often considered synonymous with risk-taking (e.g., Shapira, 1995). While risk-taking is essential to boost firm performance and to create a competitive advantage, too much of it may have drastic consequences for firms and their stakeholders (Hoskisson et al., 2016). Given that risk is subjective (Kahneman & Tversky, 1982) and corresponding responses depend on the decision-maker's individual perceptions, important behavioral implications for firms, and specifically, their top managers arise. Acknowledging the significant impact that international exposure has on top managers' cognition and perceptions (S. Nielsen, 2010b), this research article investigates whether and how CEO internationalization is associated with firms' strategic risk-taking. While internationalization, in general, is a relatively underdeveloped characteristic in upper echelons research, the internationalization among CEOs, in particular, has received only very little attention so far (Kunisch et al., 2019). Considering the ambivalent nature of risk-taking, it is of pronounced strategic importance to understand the effect that internationalization has on what are supposed to be the most powerful actors in organizations (Cannella & Holcomb, 2005).

Building on upper echelons theory and insights from the psychology and corporate governance literature, we argue that firms with international CEOs are associated with higher levels of strategic risk-taking because the international CEOs' global mindset and confidence, as well as network relationships acquired from international experiences, may lead them to engage in more risky behaviors. In order to obtain an even more detailed understanding of CEO internationalization, the article also examines the role of two contextual factors – CEO variable compensation and TMT diversity – that may act as governance mechanisms influencing the CEO's risk propensity.

Methodological approach

The hypotheses derived from the literature analysis were tested using the dataset described in section 1.3.1. The sample comprises demographic information from 1270 TMT member profiles, of which there are 279 CEO profiles. Like in article 1, the four-dimensional index of Schmid and Daniel (2006) was applied to capture the internationalization of the CEO and the TMT. The strategic risk-taking indicator (cf. Benischke et al., 2019; Kish-Gephart & Tochman Campbell, 2015) is the result of a Principal Component Analysis. It includes three firm-specific variables that are considered to reflect firms' strategic risk: R&D expenditures, capital expenditures, and long-term debt. The dataset was analyzed via panel data analysis and, more specifically, a fixed effects estimator.

Key findings & implications

The data analysis finds statistical evidence that firms led by internationally seasoned CEOs are indeed more inclined to commit to corporate strategies that involve higher levels of risk. This relationship is context-dependent on two important factors: CEO variable compensation and TMT diversity. Interestingly, in contrast to our predictions, the incentive-based compensation of the CEO does not weaken, but it amplifies the main effect. Besides, we find that the tenure diversity within the entire TMT has a weakening effect on the association between CEO internationalization and strategic risk-taking. The supplementary analysis reveals that strategic risk-taking is mainly attributable to the internationalization of the CEO but not to that of the CFO or the other TMT members, which highlights the predominant role of the CEO in the TMT.

Overall, this article advances our theoretical understanding of the firm-level implications of CEO internationalization, as well as the antecedents and boundary conditions of strategic risk-taking in MNEs. While both theory and practice mostly regard the international profile of top managers in a very positive light, this research article also points to tendencies in international CEOs that may result in somewhat unintended outcomes for firms if strategies are being pursued that entail inappropriate amounts of risk. In this context, incentive-based compensation, as well as the composition of the TMT (TMT tenure diversity specifically) that surrounds the CEO, may act as useful governance mechanisms to channel the risk-taking behavior of CEOs.

1.4.3 Summary of the third manuscript

Top managers in the digital age: Exploring the role and practices of top managers in firms' digital transformation

Background & research objectives

The digital revolution is transforming entire industries and the overall competitive landscape (Verhoef et al., 2019), which confronts firms and their top managers with new and unprecedented challenges. Although a vast amount of studies has investigated the role of top managers in firms and underlined that top managers set the firms' strategic direction (e.g., Finkelstein et al., 2009), little is known about the role of top managers in digital transformation processes. In this inductive study, we explore the particular role and facilitating actions of top managers in response to the digital transformation. The overarching goal of this article is to obtain an initial understanding of top managers in the digital age by asking the research question: *How do top managers respond to and facilitate the firm's digital transformation?* By developing a systematic framework that emerges from an extensive qualitative data analysis, this article aims to pave the way for further research on this important phenomenon.

Methodological approach

In order to obtain broad and deep insights about top managers and firms' digital transformation, we conducted 27 in-depth interviews with top managers and close associates from large, publicly listed German firms. The written interview transcripts served as the basis for an in-depth analysis of the rich dataset. To code and analyze the data, we followed the principles of grounded theory, which included constant alternations between in-depth assessments of individual cases, comparisons across all cases, as well as the development and refinement of emerging theoretical themes (Corbin & Strauss, 2015; Glaser & Strauss, 1967; Yin, 2009). The overall analytical process reflects the methodology of Gioia et al. (2013). Correspondingly, it is characterized by three phases: 1) Identifying first-order themes, 2) constructing second-order conceptual categories, and 3) condensing into the aggregate dimensions.

Key findings & implications

The data analysis reveals that top managers facilitate the digital transformation by engaging in three key actions: *understanding digitalization*, *setting the formal context for digitalization*, and *leading change*. Besides, it shows that top managers' practices in response to the digital transformation become particularly visible at multiple levels in the organization (i.e., top manager-level, firm-level, and employee-level). The corresponding impact emanating from top managers is personal (i.e., individual understanding), formal (i.e., organizational structure and processes) and informal (i.e., communication and persuasion) in nature. Finally, our findings underline that the commitment and support of the TMT is a prerequisite for the digital transformation to unfold throughout the firm. By examining the role and actions of top managers in response to the digital transformation, this research article contributes novel insights about the consequences of top managers' choices in firms. Moreover, it establishes an initial foundation for the further investigation of top managers in the digital age.

CHAPTER 2

Research article 1

A temporal perspective on the relationship between top management team internationalization and firms' innovativeness

Abstract

This study examines whether top management team (TMT) internationalization is positively related to firm innovativeness. Besides focusing on the accumulation of top managers' international knowledge and capabilities, we explore the influence of moderators reflecting temporal concerns at three levels: CEO age, TMT tenure, and firm age. Combining upper echelons theory with innovation literature and using a sample of large stock-listed German firms, we demonstrate that TMT internationalization can increase firm innovativeness. This relationship is context-dependent on the age of the CEO. Overall, this paper sheds light on the antecedents of firm innovativeness and the consequences of increasingly international TMTs.

Keywords

Upper echelons theory, top management team internationalization, firm innovativeness, R&D intensity, temporal effects

Status

The article is published open access in the journal Managerial and Decision Economics.

Wrede, M., & Dauth, T. (2020). A temporal perspective on the relationship between top management team internationalization and firms' innovativeness. *Managerial and Decision Economics*, *41*(4), 542–561. https://doi.org/10.1002/mde.3119

2.1 Introduction

The management of firms with international exposure confronts top management teams (TMTs)[8] with growing complexity and requires an understanding of both domestic and global demands (Luo, 2005). In this regard, internationally seasoned top managers are considered to be particularly qualified to cope with the posed challenges (B. B. Nielsen & Nielsen, 2011). Consequently, firms have increasingly attempted to internationalize their TMTs (Hartmann, 2015; Staples, 2007) by adding foreign nationals to the TMT, and/or appointing TMT members with international experience (Kaczmarek & Ruigrok, 2013). The internationalization of individuals may occur in many ways and comprises the experiences, knowledge, and mental models collected during times of international exposure, such as growing up in a foreign country, education or professional assignments abroad, or board mandates at foreign firms. Next to international operations, firms and their TMTs are also challenged by intensifying global competition and rapid technological advancement, which places heightened demands on firms' innovativeness (M. Du Plessis, 2007; Hitt et al., 1997; Prasad & Junni, 2017). According to Lumpkin and Dess (1996), firm innovativeness can be defined as "a firm's tendency to engage in and support new ideas, novelty, experimentation, and creative processes that may result in new products, services, or technological processes" (p.142). This engagement and support is initially dependent on the TMT, which sets the strategic direction of the firm (Talke et al., 2010), and may eventually become visible in the form of resources devoted to innovation initiatives (e.g., R&D). Due to the acting competitive forces and changing conditions engendered by the internationalization of firms and TMTs, a solid understanding of the drivers of innovativeness and ways to enhance it are of strategic importance for firms.

While prior research in the *international business* (IB) literature emphasizes the advantages of top managers' international mind-set and experience for firm-level outcomes, such as performance (B. B. Nielsen & Nielsen, 2013) or strategic decision-making (Lee & Park, 2008), empirical evidence about the influence of TMT internationalization on firm innovativeness is largely absent. Since Hambrick and Mason's seminal article, *upper echelons theory* is applied to explore the influence of different TMT characteristics on firm-level outcomes (Carpenter et al., 2004; Hambrick & Mason, 1984). While the impact of various TMT characteristics has been extensively researched [e.g., age (Barker & Mueller, 2002), tenure (Elenkov, 2008), educational level (Wiersema & Bantel, 1992)], the investigation of antecedents and

[8] The term 'top management team' describes a group of individuals responsible for leading an organization. While different definitions exist about the specific persons typically representing a TMT, this work refers to the TMT as the individuals belonging to the executive team as indicated in the annual reports.

consequences of TMT internationalization has gained momentum only recently (Schmid & Dauth, 2014). It is suggested that international experiences and nationality significantly shape a top manager's mind-set (B. B. Nielsen & Nielsen, 2011; Piaskowska & Trojanowski, 2014) and thus influence strategic decision-making within the TMT (Athanassiou & Nigh, 2000; S. Nielsen, 2010b) as well as firm performance (Carpenter et al., 2000; B. B. Nielsen & Nielsen, 2013). In this context, top managers' international experience and knowledge are considered beneficial for firms as they help TMTs to cope with international complexity and uncertainty, and to identify attractive opportunities abroad (Carpenter & Fredrickson, 2001; Tihanyi et al., 2000).

The relevance of TMT characteristics is also acknowledged in the *innovation literature*. Scholars argue that TMTs have a direct influence on innovation (Talke et al., 2011) and shape a firm's innovation strategy and performance (Elenkov & Manev, 2005). Different characteristics of top managers are supposed to act favorably toward an enhanced creative capability and innovation, such as educational level, functional expertise, or age (Bantel & Jackson, 1989; Barker & Mueller, 2002). On an aggregate level, it is the broad range of explicit and implicit experiences, knowledge, and capabilities *within* TMTs that is considered particularly crucial for innovation (Katila, 2002; Talke et al., 2011).

With this study, we aim to contribute to the IB and innovation literatures by acquiring an enhanced understanding of top managers' attributes. In particular, we investigate the relationship between TMT internationalization and firms' innovativeness. Indeed, several scholars stress the scarcity of existent research on this highly relevant characteristic of TMTs and encourage a comprehensive examination of reasons and underlying conditions that make international TMTs valuable for firms (Kaczmarek & Ruigrok, 2013; Sambharya, 1996). Additionally, Talke et al. (2010) highlight the particular value for the innovation literature to examine top managers' impact on innovation strategy and related outcomes from a firm-level standpoint instead of individual projects.

Previous inquiries of the TMT – innovation link have placed a dominant focus on diversity-related concerns (e.g., S. Nielsen, 2010a; Talke et al., 2010), supporting the notion that variety within the TMT and the existing resource pool of top managers enhances firm innovativeness. We aim to differentiate our study from extant work by bringing another determinant of innovation into the center of analysis: the *accumulation* of resources within a TMT. By 'accumulation of resources' we refer to the entirety of knowledge, experiences, skills, mental models and social ties available in the TMT. Each TMT member brings its individual resources

to the organization, which are then grouped in the TMT and synthesized with those of the other TMT members. The more unique resource elements are available, the greater the resource pool.

While innovation is created through the combination of new and existing factors (Schumpeter, 1939), it is not only the variety that matters but also the number of available elements that can be combined (Katila, 2002). In fact, a larger resource pool within the TMT can add variety (March, 1991) and increase the chances of finding novel, innovative combinations (Wu, 2014). As top managers are increasingly involved in firms' international operations (Adler, 2002; P. Greve et al., 2009; Hartmann, 2015) and participate in TMTs that unite individuals of different nationalities, they are given the chance to broaden their horizon and accumulate a pool of unique information and encounters. More specifically, top managers develop a deeper understanding about foreign markets, obtain global management skills, and establish a network of international contacts. Altogether, these international factors complement and expand the resource base beyond domestic grounds. Assuming that the accumulation of these elements is useful for innovation and may inspire the generation of novel ideas, we focus on the richness of international experiences and knowledge aggregated at the TMT-level instead of the members' differences or dispersion of a specific variable within the team.

Numerous scholars emphasize the complexity surrounding the analysis of antecedents and consequences of TMT compositions as well as innovation per sé, and request a greater attention toward contextual matters (Anderson et al., 2014; Hambrick & Mason, 1984; Talke et al., 2010). Acknowledging the complexity of the relationship between TMT internationalization and firm innovativeness, we suppose that temporal factors may significantly affect our hypothesized relationship. In fact, behavioral patterns and team dynamics are subject to constant change, reflecting the interplay of the currently present characteristics of individuals (Hambrick & Fukutomi, 1991; Harrison et al., 1998; Tuckman, 1965). Moreover, the advancement of time naturally influences the accumulation and transfer of knowledge, resources, and capabilities in teams and organizations (Peteraf, 1993; Salomon & Shaver, 2005), which impacts innovative capability.

Combining upper echelons theory with innovation literature, we argue that TMTs with international exposure are associated with a raised level of innovativeness at their corresponding firms. To investigate this relationship, we draw on a sample of firms listed on the German HDAX from 2011 to 2015 and 768 top manager profiles belonging to the respective management boards. We find empirical support for our argumentation and infer that

favorable conditions toward enhanced firm innovativeness comprise an international TMT's richness of experiences, knowledge and capabilities from different geographical locations and cultures, a favorable attitude toward risk and change, as well as a supporting network. It is not only the diversity, but also the accumulated resources within TMTs that enhance firm innovativeness. Furthermore, our results partly support the notion of temporal aspects as key influencers in the context of TMTs and firm innovativeness, and highlight the predominant role of the CEO's age. This way we complement the growing interest in time-related matters in strategy research with new insights (e.g., Chen & Nadkarni, 2017; Nadkarni & Chen, 2014).

2.2 Theory and hypotheses

2.2.1 International top managers' influence on firm-level outcomes

The influence of TMTs on a diverse range of firm-level outcomes has been discussed extensively within the upper echelons theory (Hambrick, 2007; Hambrick & Mason, 1984). The theory posits that the decisions, actions, and judgments TMTs make are influenced by the top managers' individual perceptions (Hambrick & Mason, 1984), which, in turn, are defined by their personal experiences, values, and personalities. Accordingly, top managers' cognitive base and personality are reflected in their firms' strategic actions and performance (Finkelstein et al., 2009; Hambrick & Mason, 1984).

In this context, top management is particularly regarded as a team instead of separate individuals therein, because it is assumed that strategic decisions in a firm are the result of a *joint* decision process involving multiple actors[9] (Bantel & Jackson, 1989; Carpenter et al., 2004; Cyert & March, 1963). Correspondingly, a TMT unites a broad range of values, experiences, and knowledge. Building on firms' intensifying international involvement, scholars claim that this development should be accompanied by TMTs that possess the skills and cognitive capabilities to cope with the complexity inherent in global markets (Carpenter & Fredrickson, 2001; Kaczmarek & Ruigrok, 2013). International experiences foster such a global skill- and mindset (e.g., Adler, 2002).

Existing research investigates various factors expressing TMT internationalization and their respective effects on firm-level outcomes. Two principal facets of TMT internationalization that gained particular prominence are top managers' *nationality* and *international experience*

[9] Despite the large volume of studies assuming an equal distribution of power among TMT members, we are aware of several studies that single out individual TMT members (e.g., CEO, CFO) and examine these separately (e.g., Cannella & Holcomb, 2005).

(S. Nielsen, 2010b; Oxelheim et al., 2013; Schmid & Dauth, 2014). Both are found to significantly influence top managers' mind-sets and decision-making (B. B. Nielsen & Nielsen, 2011) as well as firms' strategic positioning (Sambharya, 1996; Tihanyi et al., 2000). More precisely, *nationality* has a strong formative effect on individuals and their psychological attributes and behaviors (Hambrick et al., 1998; Hofstede, 1980). Once established, cultural patterns – and especially those acquired early in life – are deeply ingrained in a person's mind-set, therefore enduring and unlikely to fundamentally change in spite of subsequent experiences (Hofstede & Hofstede, 2005). Besides nationality, *international experiences* collected during studies, professional work, or international board mandates also strongly influence a top manager's perceptions, cognitions and personality (Herrmann & Datta, 2005). Regarded as an intangible and scarce resource by several scholars (Carpenter et al., 2000; Daily et al., 2000), international experiences equip top managers with a deeper understanding of foreign markets and customers (Herrmann & Datta, 2002), and awareness toward cultural differences (Hutzschenreuter & Horstkotte, 2013), which enables them to successfully lead their firms through cross-border operations (Carpenter et al., 2001).

2.2.2 (International) top managers' influence on firm innovativeness

Innovation literature regards top managers as key actors in the strategic innovation process (Drucker, 1985; Elenkov et al., 2005), because they set the strategic direction toward innovation and act as innovation enablers (Daellenbach & McCarthy, 1999; Talke et al., 2011). Accordingly, innovation scholars widely support upper echelons research by stressing the particular role of top managers' idiosyncrasies and inclinations as well as the TMT's composition for innovation strategy and related outcomes (R. C. Hoffman & Hegarty, 1993; Howell & Higgins, 1990; Talke et al., 2011).

Building on Schumpeter's (1939) notion of recombination, various scholars emphasize that innovation is sparked by combining both existing and novel knowledge components, or by altering the type of combination of existing components (Ahuja et al., 2008; Fleming & Sorenson, 2004). Considering that a team, such as a TMT, accumulates individual members' explicit and implicit knowledge, skills, and experiences, a rich resource pool is formed which may build a foundation for innovativeness. The greater this resource pool and the more variety among the resource elements, the higher the likelihood for novel combinations (March, 1991) and subsequent innovative ideas and products (Katila, 2002).

International exposure fundamentally influences an individual's mind-set and personality, resulting in a collection of unique experiences, which in turn may increase the volume of know-

how and skills represented in the TMT. Our argumentation regarding the impact of TMT internationalization on firm innovativeness is developed by relying on three key arguments. (i) First, we suggest that international top managers have a broader perspective on a firm's business context due to the knowledge and experiences they collected in different geographical and cultural contexts, which expands the boundaries of imagination and thereby fuels innovativeness. (ii) Second, we posit that international top managers are more risk-seeking and thus more open to change and novelties. (iii) And third, we argue that the global network international top managers maintain grants access to novel ideas and creative collaborations that are useful for innovativeness.

2.2.2.1 International top managers have a broad perspective on a firm's business context

International exposure allows individuals to broaden their perspective beyond domestic grounds (Adler, 2002) and to obtain and develop valuable cognitive abilities. A particularly relevant attribute in this context is *nationality*, because the national culture in which a top manager was socialized in from an early age has a considerable and enduring impact on his/her mind-set and values (B. B. Nielsen & Nielsen, 2011). Regarded as a shared set of assumptions and socially constructed meanings and preferences (Hofstede & Hofstede, 2005; Schein, 2016), national culture mirrors a society's comprehension of its surroundings, organizations, and interrelations (Geletkanycz, 1997). This cultural imprint becomes apparent in a top manager's interpretation of situations (Schneider & Meyer, 1991), dealing with uncertainty (Crossland & Hambrick, 2007), openness to change (Geletkanycz, 1997), and strategic decision-making (Hambrick et al., 1998). By uniting insights about both the home and host countries, a foreign national may bring a different perspective and invaluable knowledge to the organization (S. Nielsen, 2010b).

Valuable cognitive abilities and experiences are also gained through temporary international exposure, such as *international education, international work experience,* and *international linkage*. Overall, *education* is associated with top managers' cognitive orientation, open-mindedness, knowledge base, and information-processing capacity (L. T. W. Cheng et al., 2010; Hambrick & Mason, 1984; Herrmann & Datta, 2002). When occurring abroad, it offers a unique and advanced learning experience, as it allows individuals to learn about and familiarize themselves with the local conditions next to their formal studies. Norris and Gillespie (2009) even consider studies abroad as one of the best ways to develop cross-cultural communication skills and understanding. A similar effect is created by *international work experience*. Considered to be strongly formative for their careers (Gregersen et al., 1998),

international assignments provide top managers with the opportunity to gather knowledge about foreign markets and local business practices (Daily et al., 2000; P. Greve et al., 2009), and to obtain a better grasp about their firms' worldwide operations and capabilities (Carpenter et al., 2000). Besides, top managers may develop specialized skills and abilities in dealing with cross-cultural differences, and communicating with and managing people from different cultural backgrounds (Adler & Bartholomew, 1992). Another way to gain international exposure is through *international linkage* via board appointments at foreign firms. Even though board mandates may require only limited physical presence, it is critical for serving top managers to gain a comprehensive understanding of the firm's context to make proper judgments. By collaborating with fellow board members, of whom at least some are expected to represent the local firm, it is secured that a cross-border exchange of information occurs. Through these interactions, top managers may acquire critical local knowledge.

Taken together, international experiences provide top managers with the opportunity to acquire comprehensive knowledge about foreign markets (Carpenter et al., 2001; B. B. Nielsen & Nielsen, 2011) and to develop an awareness for distinct cultural patterns and potential new business opportunities (Tihanyi et al., 2000). In fact, individuals who lived abroad are found to achieve greater integrative complexity, i.e. the capacity to consider and combine multiple perspectives, which stimulates idea generation and creativity (Tadmor et al., 2012). Having observed diverging business practices and contexts abroad, top managers bring new knowledge and perspectives into the TMT (e.g., insights about alternative technologies and business models, direct and indirect competitors, competitors' commitment to R&D, etc.). These may be combined with existing ones, which establishes promising conditions for novel ideas and subsequent innovation (Godart et al., 2015; March, 1991). To exploit and commercialize these ideas, international top managers may thus invest more aggressively into innovation initiatives (Cohen & Levinthal, 1990). Prior research also suggests that managers compare their organization's performance to their personal aspiration level; gaps are commonly addressed by raising R&D investments (Cyert & March, 1963; H. R. Greve, 2003). Having seen the possibilities in foreign markets, it is likely that international top managers identify an aspiration gap, which is to be closed via increased R&D expenditure.

2.2.2.2 International top managers have a higher propensity to take risk

Our second line of argument is based on the risk perception of international top managers. Prior literature argues that international stints and collaborations involve complexity and uncertainty, due to a potential psychic and geographical distance to the host country (Hutzschenreuter et al., 2016), which requires individuals to be open and sensitive to the

unfamiliar environment, and to adapt their behavior (Adler, 2002). Through their track record of international experiences, collected via education abroad, international professional assignments, and/or mandates, top managers demonstrate global curiosity, and their readiness to immerse themselves into a different cultural context and to take on new challenges (Gregersen et al., 1998). This behavior may be a sign of a more welcoming attitude toward risk and change, which facilitates innovativeness (Damanpour, 1991).

Prior research highlighting the role of experiences for individuals' risk perception supports this notion. More specifically, experiences breed trust in that decision-makers tend to overestimate their abilities in dealing with unforeseen complications and underestimate the actual risk involved in obtaining superior outcomes once their experience levels rise beyond a certain threshold (Jemison & Sitkin, 1986; March & Shapira, 1987). Building on the formative influence of international experiences on top managers (Herrmann & Datta, 2005), Piaskowska and Trojanowski (2014) claim that top managers have gained abilities and self-confidence through international career experiences. In combination with higher core self-evaluations expected amongst top managers overall (Hiller & Hambrick, 2005), international top managers may perceive themselves to possess superior cross-border management abilities, resulting in a less negative conception of uncertainty and more daring (investment) decisions (Piaskowska & Trojanowski, 2014). Existing studies corroborate this assertion by finding empirical evidence that firms led by internationally experienced individuals are more involved in international operations (Sambharya, 1996) and more inclined toward strategic choices carrying higher levels of risk, such as foreign market entries (S. Nielsen, 2010b) or international alliances (Lee & Park, 2008). Whereas firms' international involvement reflects international TMTs' intent to seize promising global opportunities (Sambharya, 1996), the higher risk associated with international strategic choices points toward a reduced assessment of involved risks (B. B. Nielsen & Nielsen, 2011).

Overall, this lowered perception of risk of internationally seasoned top managers may also be reflected in greater resource allocations toward innovation activities (e.g., R&D[10]), which are assumed to involve substantial risk and uncertainty (Barker & Mueller, 2002; Faleye et al., 2014). Besides, their grasp of the global competitive landscape may reinforce their promotion of innovation activities to counter competitive pressures from abroad. This reasoning is supported by Schneider and Meyer (1991), who claim that interpretations of threat may trigger risk-taking (Tversky & Kahneman, 1974) and larger investments of resources, such as money (Dutton et al., 1990).

[10] R&D expenditure has been associated with enhanced firm innovativeness (Acs & Audretsch, 1987; Ahuja & Katila, 2004; Lederman, 2010). Please find further details in the methodology section.

2.2.2.3 International top managers can draw on a global network

Our final line of argument centers on top managers' global network. Indeed, scholars increasingly regard innovation as a distributed process involving the interactions of many actors (Tether, 2002) and stress the merit of global networks and relationships for innovation (Ceci & Iubatti, 2012). By *growing up in a foreign country*, spending time abroad during *international education* and *international work assignments*, and holding *interlocking directorates with foreign firms*, top managers establish a network of personal and professional contacts, e.g., with co-workers, business partners, and customers (Herrmann & Datta, 2002; Reuber & Fischer, 1997). This global network eases the access to advice (Athanassiou & Nigh, 1999), information about distant markets (Herrmann & Datta, 2005), and innovation-enabling resources, such as technologies, creativity, and novel ideas (Ahuja & Katila, 2004; Collings, 2014; Leung et al., 2008). External ties may also inspire idea generation (Mihalache et al., 2012), reveal innovation opportunities (Faleye et al., 2014), and induce collaborations with foreign business partners that foster innovation-activities (Lasagni, 2012; Sampson, 2007).

To exploit the full potential of these relationships and acquired resources, it is expected that top managers devote more resources toward leveraging inherent innovation opportunities. For instance, Faleye et al. (2014) suggest that better-connected CEOs invest more in R&D and obtain more patents of high quality. The authors attribute this effect to a reduced risk associated with investments into innovation initiatives elicited by personal ties and access to more and superior information. Furthermore, by maintaining relationships with foreign partners, top managers have a chance to learn about best practices and capabilities that make these firms successful, and to understand and identify weaknesses in their own firm (Gregersen et al., 1998). To address potential backlogs, top managers may increase their firms' R&D spending in an attempt to enhance innovativeness to eventually catch up with peers (Doraszelski, 2003) and strengthen their firms' global competitive position (Franko, 1989). Besides financial support, international top managers may also leverage their network to connect local and international R&D teams, thereby facilitating the access to and transfer of valuable local knowledge (Ambos & Schlegelmilch, 2004).

Taking into account the previously discussed features of international top managers, these individual characteristics build a rich pool of different kinds of knowledge, capabilities, and perspectives when aggregated at the TMT-level, which may act as a hotbed for novel creations and innovativeness. Next to inspiration, the understanding of possibilities and competitors abroad may also alter international TMTs' aspiration levels, resulting in an enhanced

commitment toward innovation activities (e.g., R&D expenditure) to eventually catch-up. Accordingly, we suggest:

Hypothesis 1. *There is a positive relationship between TMT internationalization and firm innovativeness.*

2.2.3 The moderating role of temporal factors

In recent years, researchers increasingly requested a greater consideration of contextual factors when investigating antecedents and consequences of TMT compositions (Carpenter, 2002; Hambrick, 2007). In line with scholars stressing that time matters in teams and business settings (Hall, 1983; Harrison et al., 2003), we expect that temporal factors may also be effective in our context and may significantly alter our predicted relationship. In fact, the passage of time affects individuals, team dynamics, as well as the accumulation and transfer of knowledge, resources, and capabilities (Peteraf, 1993; Salomon & Shaver, 2005; Tuckman & Jensen, 1977), which provides reason to believe that temporal concerns may also play a significant role for the relationship between TMT characteristics and innovation. Consequently, moderators following a "time theme" are added at the CEO, TMT, and firm levels. Building on prior research, it is expected that CEO age, TMT tenure, and firm age are particularly relevant factors affecting the relationship between TMT internationalization and firm innovativeness.

2.2.3.1 CEO age

The CEO is considered the most powerful individual in the TMT and acts not only as a leader but also as an integrator (Buyl et al., 2011; Carmeli et al., 2011) who identifies and effectively combines the TMT's inherent skills and knowledge (Georgakakis et al., 2017). Accordingly, the CEO exerts some special influence on the TMT's functioning, output, and performance (Simsek et al., 2018). The innovation literature also investigates the particular role of the CEO and regards him/her as an important enabler of innovation (Yadav et al., 2007), whose cognition influences resource allocations, such as R&D (Ahuja & Katila, 2004; Visser & Faems, 2015). Besides, scholars also pay attention to dispositions with a temporal relation, like the CEO's age and career horizon. In particular, younger CEOs are considered less conservative (Barker & Mueller, 2002; Vroom & Pahl, 1971) and thus more open to embrace change (Wiersema & Bantel, 1992) – an attribute crucial for innovativeness. Additionally, the so called 'horizon problem' postulates that CEOs tend to become more short-term focused the closer they approach retirement (Heyden et al., 2015; Matta & Beamish, 2008). This phenomenon becomes apparent, for instance, by fewer investments that entail comparatively greater risk

and a long time-span to realize potential returns, e.g. R&D (Ahuja et al., 2008) or the pursuance of lower-growth strategies (Child, 1974). In contrast, younger CEOs are more likely to promote aggressive strategic actions (e.g., acquisitions) in order to accumulate personal and organizational wealth (Yim, 2013). Since innovativeness is considered a rather long-term concern and entails risk (Barker & Mueller, 2002), we expect older CEOs to be less innovative due to their more conservative attitude toward risk and change. Given the CEO's predominant position within the TMT and influence on innovation processes, the CEO's age may be particularly reflected in TMTs' behavior toward innovations. For instance, an older CEO might impede the unconventional thinking of international TMTs and provide only limited support of innovation-enhancing actions. Consequently, we expect the effect of TMT internationalization on firm innovativeness to decrease with an increasing age of the CEO.

Hypothesis 2. *The positive relationship between TMT internationalization and firm innovativeness will be negatively moderated by CEO age.*

2.2.3.2 TMT tenure

In both theoretical discussions and empirical investigations, TMT tenure is suggested as a particularly influential factor for top managers' decision-making (Elenkov, 2008). In particular, Hambrick and Fukutomi (1991) propose that managers go through different phases during their tenure, which influence their patterns of attention and behavior. Numerous studies support this assertion. For example, scholars claim that long-term belonging to the same firm is accompanied by an individual's narrowed perspective and a disconnection from external sources of information (Katz, 1982; Pfeffer, 1983). Similarly, top managers with long tenure in an organization have developed a greater psychological and tangible investment in the firm (Simsek, 2007), which tends to make them more risk-averse (D. Miller & Shamsie, 2001), as well as less likely to challenge the status quo (Finkelstein & Hambrick, 1990) and advocate change (Finkelstein & Hambrick, 1996). Spending patterns toward innovation-enhancing R&D reflect this phenomenon, too: long-tenured managers are less pressured to prove themselves and thus employ a more conservative approach to R&D investments (Kor, 2006).

On the TMT-level, this growing conservatism progressing with tenure means a strong effect on the available cognitive resources. In fact, a TMT comprising individuals with long tenure in the organization is expected to possess a more narrowed resource base due to the similar experiences members have made and the common organizational values they share (Bantel & Jackson, 1989; Schmidt & Posner, 1983). Likewise, researchers propose that the longer a team

works together, the more it approaches a unified viewpoint and the value of different kinds of knowledge gradually levels off (Finkelstein & Hambrick, 1990). Acknowledging that a broad collection of perspectives and backgrounds is vital for innovativeness (Talke et al., 2011), and innovation is sparked by the combination of existing and novel knowledge and ideas (Heyden et al., 2012; Schumpeter, 1939), we expect that a longer TMT tenure hampers the optimal recombination of available (international) knowledge elements and thus a firm's innovativeness.

Hypothesis 3. *The positive relationship between TMT internationalization and firm innovativeness will be negatively moderated by TMT tenure.*

2.2.3.3 Firm age

Prior studies suggest that a firm's age affects its innovativeness. For instance, Hansen (1992) finds that firm age is inversely related to the number of new products per dollar of sales. This relationship may be explained by the stable routines and structures firms develop once they grow older, resulting in rising organizational inertia (Hannan & Freeman, 1984) that hampers firms' flexibility and responsiveness to changes in the external environment. While established organizational know-how becomes obsolete as firms in dynamic environments age (Sørensen & Stuart, 2000; Tushman & Anderson, 1986), their propensity to innovate is reduced in comparison to more agile firms.

Still, stable routines may be considered not only a curse, but also a blessing: Over time, more mature firms may have refined their innovation capabilities, raising not only their overall innovativeness level but also the benefits gained from R&D investments (Coad et al., 2016). Consequently, it may be inferred that older firms refrain from aggressive R&D investments to promote innovativeness. This notion is supported by scholars suggesting that innovation activities (e.g. R&D) decline with firm age (Huergo & Jaumandreu, 2004; Withers et al., 2011). Whereas more mature firms tend to exploit existing capabilities (Sørensen & Stuart, 2000), younger firms first need to build innovation capabilities before they are ready to compete on the market. Since R&D investments stimulate a firm's innovation capability (Acs & Audretsch, 1988; Barker & Mueller, 2002), younger firms, or those striving for market entry, may thus devote relatively more resources toward R&D (Coad et al., 2016) in order to get a foothold in the industry and strengthen their competitive position in comparison to older, more established firms. Hence, we expect the effect of TMT internationalization on firm innovativeness to be more pronounced in younger firms, as top managers may have greater

leeway in letting their individual ideas unfold and pushing their firms toward enhanced innovativeness. Accordingly, we hypothesize:

Hypothesis 4. *The positive relationship between TMT internationalization and firm innovativeness will be negatively moderated by firm age.*

2.3 Methodology

2.3.1 Sample and data collection

Our empirical analysis is based on a sample of MNEs listed on the German HDAX[11] index. We consider Germany to be particularly suitable for our study because it is highly ranked in the Global Innovation Index (Cornell University et al., 2019) and the majority of sales of firms listed on the German stock exchange are generated on an international level (Dauth et al., 2017; Schmid & Dauth, 2012). These are indications of German firms' innovative capability and their strong international involvement. Internationalization has also particularly progressed in German executive suites, as demonstrated by Hartmann's (2015) comparative study on the internationalization of top managers of the largest firms of Germany, France, Great Britain, United States, Japan, China, Italy, and Spain.

The German corporate governance system prescribes a two-tier board structure for stock-listed corporations ('Aktiengesellschaften'), distinguishing between the management board ('Vorstand') and the supervisory board ('Aufsichtsrat') (J. J. Du Plessis et al., 2012). Due to its responsibility for the firm's strategic and operational decision-making (J. J. Du Plessis et al., 2012), we base our analysis on the former. Specifically, the management board influences firm innovativeness directly by setting the firm's strategic direction toward innovation (Talke et al., 2010), determining the resources allocated toward innovation actions (Talke et al., 2011), and instilling a culture of innovativeness in the firm (Sperber, 2016).

Our study entailed a rigorous data collection process. Of the 110 HDAX-listed firms in June 2016, we excluded 16 firms belonging to the banking, insurance, and real estate industries, which are considered less research-intensive (Rammer et al., 2017) and thus could have distorted our findings. For the remaining firms, we then identified the respective members of the management boards over the years 2011, 2013 and 2015 via the firms' annual reports.

[11] The HDAX combines all 110 firms listed on the indices DAX30 (30 firms), MDAX (50 firms), and TecDAX (30 firms) and includes the most liquid and largest firms traded in the prime-standard segment of the Frankfurt Stock Exchange (STOXX Ltd., 2016).

Afterwards, we collected demographic information on all top managers by conducting in-depth analyses of respective curriculum vitae (CVs), firm websites, and other public profiles online (e.g., LinkedIn, Xing). This reliance on bibliographic data is a common approach in upper echelons research (S. Nielsen, 2010b; Schmid & Wurster, 2017). Eventually, we compiled information on 256 individuals in 2011, 259 individuals in 2013, and 253 individuals in 2015.[12] This data was matched with corresponding firm-level indicators drawn from the database Thomson ONE Banker. Finally, 38 firms were dropped that had no activity in a research-intensive industry[13], no R&D investments, and/or that had TMT members with incomplete profiles. The final sample comprises 56 firms, 280 firm-year observations, and demographic information on 358 different TMT members (i.e., 768 "profile-years").

2.3.2 Dependent variable: Firm innovativeness

To operationalize *firm innovativeness*, we employ the measure of R&D intensity – a common proxy for innovativeness (Richard Adams et al., 2006; Daellenbach & McCarthy, 1999). In general, R&D investments are considered to reflect the strategic importance of innovation for firms (Hill & Snell, 1988; Kor, 2006) and to be a critical ingredient for their innovative capability (Ahuja & Katila, 2004; V. Kumar, 2014). Prior research also claims that firms spending more on R&D are more innovative (Acs & Audretsch, 1987; Lederman, 2010); reductions in R&D may even impair firms' innovative capability and long-term competitiveness (Helfat, 1997; Heyden et al., 2015).

Another argument in support of this operationalization is that scholars assume that R&D investments are influenced by the TMT (Barker & Mueller, 2002). The innovation literature distinguishes between input measures (e.g., R&D intensity) and output measures (e.g., patents) of innovation (Richard Adams et al., 2006; Lin et al., 2011). Since the final innovative output is a product of numerous different actors and actions (Ahuja et al., 2008), we expect that top management's actual involvement is hard to discern when using an output measure. In contrast, input measures reflect a closer proximity between top management and innovation inputs, as top management is generally assumed to have the discretion to control the level of R&D investment (Barker & Mueller, 2002; Green, 1995).

[12] Since certain TMT members' individual characteristics are not expected to change significantly (e.g., nationality and international education), we filled the "gap years" 2012 and 2014 by calculating the mean scores using the preceding/following data collection periods.

[13] Industries with a one-digit SIC code of 2, 3, or 4 are considered research-intensive (i.e., manufacturing, transportation, communications, electric, gas & sanitary services) (Rammer et al., 2017).

Overall, R&D intensity is a ratio widely employed in innovation studies (e.g., Hambrick & Macmillan, 1985; Un, 2016). As it puts firms' R&D spending in relation to total sales, it foregoes problems of an artificial relation with firm size (Hitt et al., 1997). Another benefit is that it encompasses an entire firm's R&D expenditure, which matches our aim of employing a firm-level perspective to investigate senior management's influence on firm innovativeness. We take the average of the values of the year under investigation and the following year to limit the possibility of a potential bias caused by exceptionally high or low values for R&D intensity in one specific year (Daellenbach & McCarthy, 1999). By considering also the following year, we account for the fact that the effects of TMT decisions-making may become visible only later and thereby address potential reverse causality concerns.

2.3.3 Independent variable: Top management team internationalization

The internationalization of individuals can occur in multiple ways. While often measured through a unidimensional construct in existing studies (S. Nielsen, 2010b), more recent research recommends employing a more comprehensive approach to counter the potential neglect of other relevant facets of a top manager's internationalization (Carpenter & Reilly, 2006; Oxelheim et al., 2013). To draw a more fine-grained picture of a top manager's internationalization, we calculate an index that accounts for four internationalization indicators: (i) nationality, (ii) international education, (iii) international work experience, and (iv) international board appointments. These elements reflect crucial stages in the life and career of an individual, during which essential international experiences and knowledge are collected (Carpenter & Westphal, 2001; Dickmann & Harris, 2005; Hambrick et al., 1998; Norris & Gillespie, 2009). Based on these elements, an internationalization score is calculated for each top manager. Subsequently, a team-level average of all scores is computed, representing the final values for the index variable *TMT internationalization*. This approach is embodied in the following equation:

$$\text{INT} = \frac{1}{n} * \sum_{i=1}^{n} \left[\frac{1}{4} \left(F_i + \left(1 - \frac{1}{E_i+1}\right) + \left(1 - \frac{1}{W_i+1}\right) + \left(1 - \frac{1}{A_i+1}\right) \right) \right] \qquad (1)$$

F_i represents the foreignness of person i relative to a firm's home country (i.e., F_i = 0 if the person's nationality is German; F_i = 1 for any other nationality). E_i is the number of years of higher education spent abroad. W_i is the number of years of international work experience. A_i is the number of appointments to boards of foreign firms. n is the number of individuals in the TMT.

2.3.4 Moderating variables

We employ moderators at the CEO, TMT and firm levels that aim to reflect the temporal influences on team dynamics and the accumulation and transfer of resources. To calculate the *CEO's age*, we deduct the year of birth from the respective year under consideration (i.e., 2011-2015). Moreover, we calculate *TMT tenure* as the mean tenure of TMT members in the particular firm. For the firm-level moderator, we follow Un (2016) and calculate *firm age* by subtracting the founding year from the respective year under consideration.

2.3.5 Control variables

We also control for several firm and TMT characteristics. Regarding firm-related variables, we consider firm size, measured as the logarithm of the number of employees (S. Nielsen, 2010b). Because the probability to send employees on foreign assignments and promote those with international experiences is higher for global than for national firms (Baruch & Altman, 2002; Hamori & Koyuncu, 2011), we control for firms' degree of internationalization, proxied by the intensity of *foreign sales* (i.e., the ratio of foreign sales to total sales) (Hamori & Koyuncu, 2011). Moreover, we include *Return on assets (ROA)* as proxy for firms' current profitability. Prior research shows that whereas profitability raises managers' confidence to invest in more risky long-term projects (e.g., R&D), the opposite may result in curtailed efforts (Barker & Mueller, 2002; Hundley et al., 1996). Finally, we add dummy variables to control for whether a firm's main business focus is based on a research-intensive industry[14] and for the respective HDAX sub-index[15] on which a firm is listed. In this way, we account for the heterogeneity of firms in our sample.

Regarding TMT-related variables, we control for *TMT size,* represented by the number of individuals on the TMT as listed in the annual report of the respective year (Tihanyi et al., 2000). The larger a TMT, the higher the likelihood that internationally experienced top managers serve on it and the more resources, in terms of human and social capital, are available (Kaczmarek & Ruigrok, 2013). Moreover, we include *TMT mean age*. Recent studies have demonstrated that younger and older individuals differ in their perception and processing of information (Thomas & Millar, 2012), and attitude toward risk (Herrmann & Datta, 2005). Furthermore, TMT mean age reflects the accumulation of life experiences, beliefs, and generational ideologies of its members (Heyden et al., 2015). Another control variable is *uncertainty avoidance* to capture the extent to which TMT members' cultural

[14] The dummy is coded one if the firm's primary SIC code begins with 2, 3, or 4 (i.e., research-intensive industries) and zero otherwise.

[15] Our sample comprises 23 *DAX30* firms, 18 *MDAX* firms, and 15 *TecDAX* firms.

backgrounds affect their attitude toward uncertainty and risk, and thus openness to change and novelty as reflected in innovativeness (Crossland & Hambrick, 2007). The variable builds on insights from the GLOBE study[16] (House et al., 2013), which suggests that cultures differ along certain dimensions and to varying degrees. It is computed by averaging the individual GLOBE uncertainty avoidance scores of all TMT members according to their respective nationalities.

Additionally, we control for diversity-related variables at the TMT-level. Prior research stresses the overall merit of diversity for TMTs' creativity, innovation orientation, and performance (Hambrick, 2007; Wiersema & Bantel, 1992), because diversity provides multiple perspectives and resources, resulting in enhanced problem-solving capabilities (Talke et al., 2011). We add *TMT gender diversity*, because women bring distinctive background experiences, knowledge, and viewpoints to the TMT (Huse, 2007), which broaden the TMT's resource base and enhance its capacity to make innovative linkages and combinations (Ruiz-Jiménez et al., 2016). TMT gender diversity is operationalized using the Blau (1977) index, calculated as $(1-\sum p_i^2)$, where p_i is the proportion of TMT members in the *i*th category. Another control variable is *TMT age diversity*. Following Allison (1978) we operationalize the variable via the coefficient of variation (i.e., standard deviation divided by the mean) for each TMT. Age diversity brings a broad spectrum of skills, knowledge, and perspectives to the TMT, which may augment creativity and problem-solving (Ji Li et al., 2011), resulting in better innovative capabilities. Furthermore, we control for the *TMT's degree of foreignness*, estimated by the percentage of foreign nationals (i.e., non-Germans) on the TMT (Piaskowska & Trojanowski, 2014).

2.3.6 Analytical approach

We analyzed our dataset comprising five years of data per firm using pooled OLS regressions. As suggested by different scholars dealing with this type of data (see Dauth et al., 2017; Nguyen et al., 2018; Petersen, 2009), we cluster the standard errors along two dimensions – firm and year – to control for temporary time-series and cross-sectional dependence in the residuals. Moreover, we include year-fixed effects to control for fixed time-variant characteristics. Before carrying out the analysis, we performed different tests to secure the validity of our regression results. Among others, the variables were tested for the normality condition to prevent

[16] We deliberately rely on the uncertainty dimension scores of the GLOBE study. Whereas the Hofstede study developed its cultural dimensions at the national level (Minkov and Hofstede, 2011), GLOBE measures culture at both the societal and organizational levels and thereby allows for interpretations at the individual level (Chhokar et al., 2012). Additionally, the GLOBE study builds on more recent data.

specification errors caused by a misspecified functional form. Consequently, most variables are included in their normal form. Besides, we tested for multicollinearity by calculating the variance inflation factors (VIFs). As the VIFs all score below 10, multicollinearity does not appear to be an issue (Hair et al., 2006).

2.4 Results

2.4.1 Results of the main analysis

Table 3 illustrates the descriptive statistics for all variables in our regression models. The corresponding correlation coefficients are shown in Table 4.

Table 3: Descriptive statistics

Variables	Mean	Standard Deviation	Min	Max	Observations
R&D intensity	5.434	9.215	0.030	104.400	280
TMT internationalization	0.301	0.169	0	0.770	280
CEO age	54.268	5.634	42	72	280
TMT tenure	13.850	6.026	2.250	28.800	280
Firm age	83.636	51.693	5	188	280
TMT size	4.5357	1.796	2	10	280
TMT age	52.450	3.269	41.670	61	280
Uncertainty avoidance	5.097	0.168	4.220	5.220	280
TMT gender diversity	0.055	0.122	0	0.480	280
TMT age diversity	0.101	0.044	0	0.240	280
TMT foreignness	0.206	0.220	0	0.860	280
Firm size	9.698	1.789	5.700	13.321	280
Foreign sales	68.485	18.252	2.490	100	280
ROA	5.351	4.978	-22.310	22.960	280
R&D industry	0.857	0.351	0	1	280

Table 4: Pearson correlations among regression variables

	R&D intensity	TMT intern.	CEO age	TMT tenure	Firm age	TMT size	TMT age	Uncertainty avoidance	TMT gender diversity
R&D intensity	1								
TMT internationalization	0.051	1							
CEO age	-0.04	-0.003	1						
TMT tenure	-0.11	-0.021	0.312*	1					
Firm age	-0.228*	0.015	0.118*	0.212*	1				
TMT size	-0.156*	0.233*	0.297*	0.352*	0.176*	1			
TMT age	-0.097	0.013	0.664*	0.435*	0.151*	0.3723*	1		
Uncertainty avoidance	-0.008	-0.590*	-0.274*	-0.059	0.157*	-0.267*	-0.219*	1	
TMT gender diversity	0.229*	-0.0456	-0.054	0.056	0.044	0.365*	-0.048	0.065	1
TMT age diversity	-0.093	-0.227*	0.029	0.043	-0.033	-0.033	-0.082	0.036	-0.046
TMT foreignness	0.051	0.783*	0.058	-0.064	-0.157*	0.159*	0.04	-0.690*	-0.087
Firm size	-0.422*	0.204*	0.382*	0.312*	0.287*	0.705*	0.459*	-0.206*	0.158*
Foreign sales	0.252*	0.067	0.194*	0.128*	-0.081	0.066	0.245*	-0.212*	0.003
ROA	-0.210*	-0.06	-0.107	0.112	0.149*	0.008	-0.146*	0.02	-0.092
R&D industry	-0.221*	-0.083	-0.017	0.131*	0.313*	-0.003	0.076	0.156*	0.026

Table 4: Pearson correlations among regression variables (continued)

	TMT age diversity	TMT foreignness	Firm size	Foreign sales	ROA	R&D industry
⋮						
TMT age diversity	1					
TMT foreignness	-0.106	1				
Firm size	-0.11	0.08	1			
Foreign sales	-0.166*	0.144*	0.004	1		
ROA	0.109	-0.092	-0.037	-0.055	1	
R&D industry	-0.129*	-0.122*	0.098	-0.006	0.029	1

Notes: * $p<0.05$

Table 5: Results of the analysis with firm innovativeness as dependent variable

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
TMT internationalization	13.770*	68.140**	23.470**	17.120*	66.360**
	(7.508)	(28.570)	(10.470)	(9.998)	(29.210)
CEO age × TMT intl.		-1.001**			-0.882*
		(0.448)			(0.458)
TMT tenure × TMT intl.			-0.687		-0.276
			(0.418)		(0.451)
Firm age × TMT intl.				-0.044	-0.010
				(0.065)	(0.062)
CEO age	0.349**	0.611***	0.376**	0.335**	0.587***
	(0.161)	(0.208)	(0.163)	(0.156)	(0.206)
TMT tenure	-0.023	-0.003	0.190	-0.018	0.0816
	(0.084)	(0.084)	(0.156)	(0.083)	(0.167)
Firm age	-0.003	-0.005	-0.001	0.012	-0.001
	(0.015)	(0.015)	(0.015)	(0.026)	(0.024)
TMT size	0.219	0.131	0.094	0.210	0.089
	(0.431)	(0.434)	(0.458)	(0.434)	(0.455)
TMT age	0.106	0.164	0.089	0.104	0.150
	(0.203)	(0.217)	(0.194)	(0.199)	(0.215)
Uncertainty avoidance	5.066	0.700	4.169	6.242	1.134
	(6.508)	(4.960)	(6.157)	(6.597)	(4.892)
TMT gender diversity	20.540	21.630	21.140	20.420	21.710
	(13.900)	(13.890)	(13.950)	(13.960)	(13.930)
TMT age diversity	-19.550**	-16.690	-18.750**	-19.900**	-16.790*
	(9.476)	(10.480)	(9.301)	(9.311)	(10.050)
TMT foreignness	-5.453	-7.969*	-6.443	-5.138	-7.993*
	(4.493)	(4.606)	(4.441)	(4.439)	(4.461)
Firm size	-2.982**	-2.840**	-2.804**	-2.907**	-2.768**
	(1.366)	(1.347)	(1.360)	(1.371)	(1.355)
Foreign sales	0.093**	0.098***	0.095**	0.097**	0.099***
	(0.037)	(0.037)	(0.037)	(0.038)	(0.038)
ROA	-0.232*	-0.197	-0.219	-0.231*	-0.196
	(0.127)	(0.128)	(0.133)	(0.131)	(0.130)
R&D industry	-3.029	-3.328	-3.232	-3.019	-3.372
	(3.472)	(3.480)	(3.473)	(3.488)	(3.488)
Constant	-19.720	-15.980	-20.020	-26.980	-18.690
	(34.360)	(30.220)	(33.420)	(34.840)	(30.930)
Index Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	280	280	280	280	280
F-statistic	7.447***	6.929***	7.079***	7.631***	6.390***
R^2	0.479	0.491	0.484	0.480	0.492
Adj. R^2	0.439	0.450	0.442	0.438	0.447
ΔR^2	*Baseline*	0.012***	0.005***	0.001***	0.013***

Notes: *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses; Beta coefficients presented in non-standardized form.

To analyze the impact of TMT internationalization on firm innovativeness, we estimate five regression models. The results are shown in Table 5. In Model 1, we test the direct relationship between TMT internationalization and firm innovativeness. In support of Hypothesis 1 and our core argumentation, the results indicate a significant and positive relationship between TMT internationalization and firm innovativeness (ß = 13.77; p < 0.1). Accordingly, Hypothesis 1 is supported. Besides, we find positive influences of CEO age (ß = 0.349, p < 0.05), TMT age diversity (ß = -0.19.55; p < 0.05), firm size (ß = -2.982; p < 0.05), foreign sales (ß = -0.0932; p < 0.05), and ROA (ß = -0.232; p < 0.1).

The subsequent models build upon Model 1 and refine the direct relationship between TMT internationalization and firm innovativeness through the addition of different moderators with a temporal relation. For Model 2, we add the moderator *CEO age*. Our independent variable TMT internationalization remains significant with the expected sign (ß = 68.14; p < 0.05). Furthermore, CEO age significantly and negatively moderates the relationship between TMT internationalization and firm innovativeness (ß = -1.1001; p < 0.05), which lends support to Hypothesis 2. In Model 3, the moderator *TMT tenure* is included. The coefficient for TMT internationalization is again significant and positive (ß = 23.47; p < 0.05). However, we do not find support for Hypothesis 3, which suggested a negative influence of *TMT tenure* on the relation between TMT internationalization and firm innovativeness (ß = -0.687; p > 0.1). Model 4 includes the moderator *firm age*. Although the coefficient for TMT internationalization remains significant and positive (ß = 17.12; p < 0.1), our results do not substantiate Hypothesis 4, which predicted a negative effect of *firm age* on the relationship between TMT internationalization and firm innovativeness (ß = -0.0443; p > 0.1). Hence, hypothesis 4 is not supported. Model 5 (the full model) encompasses all variables. By including all variables simultaneously, we assume that an enhanced illustration of the relationship between TMT internationalization and firm innovativeness is achieved. The results mirror those of the previous models: significance is indicated for TMT internationalization; of the moderators with a temporal relation, only CEO age is significant. Throughout all models, additional significant effects are found for *CEO age* as a direct predictor and the firm-related control variables *firm size* and *foreign sales*[17].

[17] Thanks to the thoughtful remark of an anonymous reviewer, we repeated our data analysis and re-estimated our models with *foreign sales* (i.e., the ratio of foreign sales to total sales) added as a moderator variable. The results indicate that *foreign sales* has no significant influence on the relationship between TMT internationalization and firm innovativeness.

2.4.2 Robustness checks

To check the robustness of our findings, we perform additional tests by altering the specifications of our models. Even though our theoretical derivation underlines the importance of including the discussed control variables in our analysis, the non-significance of several control variables in our main analysis suggests that a potential estimation bias may affect our results. To control for this potential bias, we exclude certain variables from the main models and/or replace them by other variables. The results are reported in Table 6.

Table 6: Robustness checks

VARIABLES	Robustness Model 2a	Robustness Model 2b	Robustness Model 3a	Robustness Model 3b
TMT internationalization	67.440**	52.060**	17.840*	12.540*
	(28.650)	(25.020)	(10.600)	(6.943)
CEO age × TMT intl.	-0.993**	-0.885*		
	(0.463)	(0.452)		
TMT tenure × TMT intl.			-0.263	-0.612
			(0.447)	(0.439)
Firm age × TMT intl.				
CEO age	0.653***	0.493**	0.229	0.246*
	(0.232)	(0.198)	(0.144)	(0.130)
TMT tenure	0.022	0.029	0.095	0.191
	(0.084)	(0.091)	(0.155)	(0.169)
Firm age	-0.005	0.002	-0.008	0.007
	(0.015)	(0.013)	(0.016)	(0.014)
TMT size			0.395	
			(0.433)	
TMT age			0.075	
			(0.215)	
Uncertainty avoidance			2.128	
			(6.184)	
TMT gender diversity	21.820		22.280	
	(13.310)		(13.660)	
TMT age diversity	-17.580		-15.060	
	(10.700)		(11.990)	
TMT foreignness	-8.043*		-6.494	
	(4.649)		(5.235)	
Diversity				
Firm size	-2.676**	-2.410*	-3.109***	-2.376*
	(1.249)	(1.371)	(0.956)	(1.364)
Foreign sales	0.100***	0.108**	0.100***	0.103**
	(0.038)	(0.052)	(0.034)	(0.052)
ROA	-0.207*	-0.270**	-0.302**	-0.296**
	(0.125)	(0.131)	(0.137)	(0.142)
R&D industry	-3.317	-2.837	-4.358	-2.735
	(3.430)	(4.149)	(3.323)	(4.144)
Constant	-7.482	-2.092	2.495	8.682
	(11.840)	(13.650)	(34.860)	(14.320)
Index Effects	*Yes*	*Yes*	*Yes*	*Yes*
Year Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*
Observations	280	280	280	280
F-statistic	7.460***	8.068***	4.340***	8.539***
R^2	0.490	0.390	0.448	0.382
Adj. R^2	0.454	0.355	0.407	0.347

Notes: *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses; Beta coefficients presented in non-standardized form.

Table 6: Robustness checks (continued)

VARIABLES	Robustness Model 4a	Robustness Model 4b	Robustness Model 5a
TMT internationalization	17.900*	17.120**	65.920**
	(10.390)	(8.059)	(29.550)
CEO age × TMT intl.			-0.868*
			(0.477)
TMT tenure × TMT intl.			-0.344
			(0.416)
Firm age × TMT intl.	-0.046	-0.114*	-0.006
	(0.066)	(0.068)	(0.063)
CEO age	0.368**	0.240	0.625***
	(0.165)	(0.151)	(0.237)
TMT tenure	-0.039	0.060	0.123
	(0.086)	(0.091)	(0.154)
Firm age	0.007	0.0313	-0.002
	(0.026)	(0.025)	(0.026)
TMT size	0.252	-0.149	
	(0.428)	(0.405)	
TMT age	0.090	0.106	
	(0.195)	(0.229)	
Uncertainty avoidance	6.318	10.220*	
	(6.015)	(5.662)	
TMT gender diversity	20.000		21.790
	(14.350)		(13.350)
TMT age diversity	-17.290***		-17.690*
	(6.396)		(10.410)
TMT foreignness	-5.360		-8.321*
	(4.140)		(4.632)
Diversity		9.520**	
		(4.777)	
Firm size	-2.990**	-2.825**	-2.622**
	(1.510)	(1.372)	(1.244)
Foreign sales	0.096**	0.104***	0.101***
	(0.038)	(0.038)	(0.039)
ROA	-0.221*	-0.303**	-0.206
	(0.125)	(0.132)	(0.127)
R&D industry		-2.770	-3.375
		(3.341)	(3.447)
Constant	-29.930	-45.400	-8.586
	(32.460)	(28.440)	(12.030)
Index Effects	*Yes*	*Yes*	*Yes*
Year Fixed Effects	*Yes*	*Yes*	*Yes*
Observations	280	280	280
F-statistic	7.451***	8.078***	7.058***
R^2	0.470	0.490	0.491
Adj. R^2	0.429	0.453	0.452

Notes: *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses; Beta coefficients presented in non-standardized form.

For model 2, we exclude the TMT-related control variables *TMT size, TMT mean age,* and *uncertainty avoidance* (Models 2a, b), and the diversity-related control variables *TMT gender diversity*, *TMT age diversity*, and *TMT foreignness* (Model 2b). For model 3, we exclude the index dummy (Model 3a), and the TMT-related variables *TMT size, TMT mean age,* and *uncertainty avoidance,* as well as TMT diversity-related controls (Model 3b). For model 4, we exclude the *Industry* control variable (Model 4a) and the diversity-related controls are replaced by a diversity dummy (Model 4b). The dummy captures the gender diversity and degree of foreignness variables and takes on a value of 1 if both variables show heterogeneity, and 0 otherwise. The age diversity dimension is not included in this composite, because age diversity (operationalized through the coefficient of variation) is typically present in any TMT. Model 5a excludes the TMT-related controls. Essentially, the variables of main interest remain stable to all changes in the model specifications, which confirms the robustness of our results.

2.5 Discussion and conclusions

Despite the rising presence of internationally seasoned individuals on management boards and an increasing interest in top managers by academia, our empirical understanding about the influence of the characteristics and internationalization of upper echelons is far from complete (S. Nielsen, 2010a; Oxelheim et al., 2013). With our research, we aim to contribute relevant insights to the IB and innovation literatures and respond to two contemporary trends in business: first, TMTs are becoming increasingly international (Hartmann, 2015; Staples, 2007); second, global competitive forces put pressure on firms' innovativeness (Prasad & Junni, 2017). Based on these developments, our study sheds light on the theoretical relationship between TMT internationalization and firm innovativeness.

We argue that international exposure provides top managers with unique learning opportunities about foreign markets, its people, and local business practices. Our findings support the notion that TMTs comprising both nationals and non-nationals as well as individuals with international experience benefit from a much broader resource base than homogeneous TMTs that are limited to domestic grounds. Since innovation is sparked by the combination of novel and existing resource elements (Schumpeter, 1939), this broader resource pool increases the likelihood for finding new, innovative combinations (Katila, 2002).

Combining upper echelons theory with innovation research, we add to existing literature not only by refining the core tenet of upper echelons research that TMTs influence firm-level

outcomes (Hambrick & Mason, 1984), but also by contributing insights about the particular impact international TMTs have on firm innovativeness. In this way, we advance our theoretical understanding about the implications of a relatively under-studied characteristic in TMT research (Kaczmarek & Ruigrok, 2013). Our study's results align with prior studies examining TMT internationalization, which predict positive effects on firm-level outcomes, such as enhanced financial performance (Carpenter et al., 2000). Accordingly, they re-emphasize the relevance of international TMTs.

We also extend our comprehension of TMTs' influence on firm innovativeness from a methodological standpoint. By concentrating on the *accumulation* of resources within the TMT, we depart from studies that explain TMTs' influence on firm-level outcomes, and specifically innovation, by means of diversity in TMT members' idiosyncrasies (e.g., Talke et al., 2010). So far, the discussion revolving around the benefits and implications of TMT diversity has remained controversial, resulting in calls for alternative explanations regarding the actual impact that distinct TMT compositions have on firms (S. Nielsen, 2010a). By focusing on accumulation, we provide an alternative perspective on the TMT - firm decision-making link and suggest that it is not only the heterogeneity across top managers' values, capabilities, and knowledge that matters, but also the volume. This argument reinforces the key notion of the knowledge-based view, which builds on the resource-based view and claims that value is mainly generated by tacit, knowledge-based assets (Fey & Furu, 2008; Sveiby, 1997) that are stored within individuals (Grant, 1996). By acquiring knowledge from foreign places as well as global management skills, the resource base may be expanded beyond domestic borders, resulting in a vaster pool of resources based on which innovations can develop. This reasoning aligns with innovation studies that encourage firms striving to increase their innovative output to search for novel components beyond domestic confines (Rosenkopf & Almeida, 2003; Savino et al., 2017). Our study illustrates that international TMTs are valuable human vehicles for collecting and sourcing such foreign knowledge and capabilities.

Besides implications for firms' innovation efforts, our focus on accumulation also complements previous diversity research which claims that diversity may introduce separation in TMTs, resulting in greater levels of conflict, behavioral disintegration and subsequent low performance (Barkema & Shvyrkov, 2007; S. Nielsen, 2010a). While firms often feel the urge to encourage diversity ("Diversity Fatigue," 2016), our study highlights the merit of the aggregation of knowledge, perspectives, and capabilities for innovativeness. Striving for a greater resource base may thus represent another option to create value and foregoes the potential problems associated with diversity.

Our study also provides contributions to innovation scholars, who consider top managers as key actors in the innovation process (Elenkov & Manev, 2005). Accompanying firms' pursuit of augmenting their innovativeness, our findings underline that the *internationalization* of TMTs is an important lever to consider. This insight is particularly useful in a fast-paced, complex environment, in which intensifying competition from national and international players, as well as young firms with disruptive ideas, consistently challenge the status quo (McKinsey Global Institute, 2015). Consequently, firms are forced to constantly question their long-term competitiveness and success, of which innovativeness is a central aspect (Hitt et al., 1997). Making optimal use of available resources (e.g., international human capital) and adapting strategies accordingly are thus of strategic importance.

Besides, we advance research of both TMT and innovation scholars who emphasize the importance of context when investigating the consequences of TMT compositions (Carpenter et al., 2004). Since the passage of time affects human and organizational decision-making, team dynamics as well as the accumulation of resources relevant for innovations (Peteraf, 1993; Tuckman, 1965), we devote particular attention to temporal factors at the CEO, TMT, and firm levels. This way, we partake in the emerging discussion in strategy research that attends to temporal concerns of individuals and their implications for firms (e.g., time perceptions of the CEO and the influence of innovation (Nadkarni & Chen, 2014; Yadav et al., 2007)). Our findings partly underline the significance of time in the context of TMTs and contribute toward a more nuanced understanding about the implications of TMT internationalization. Of the three variables hypothesized to impact the relation between international TMTs and firm innovativeness, CEO age is found to play a significant role. In line with prior studies (e.g., Hambrick & Fukutomi, 1991; Simsek et al., 2018), this finding particularly stresses the predominant role and superior discretion of the CEO, and specifically his/her age. More specifically, our analysis suggests that more elderly CEOs attenuate the gains in firm innovativeness introduced by international TMTs. This result supports prior research claiming that older CEOs are more conservative and thus promote innovations less (Barker & Mueller, 2002).

By paying particular attention to temporal factors, we also contribute to leadership theories (Shamir, 2011). Although our study does not specifically test the changing leadership characteristics over time, it still complements recent claims for a wider consideration of temporal factors in leadership studies (Bluedorn & Jaussi, 2008; Shamir, 2011). So far, leadership studies have widely neglected time-related aspects even though the passage of time fundamentally affects the relationship between leaders and followers (Shamir, 2011). Our

findings suggest that CEO age is an aspect to be considered in dynamic leadership studies as the CEO's age obviously changes the dynamics within and decision-making of the TMT. By shedding light on underlying influencing patterns within TMTs, we also add novel insights to research on the CEO-TMT interface – a topic which has attracted increasing attention within upper echelons research (Georgakakis et al., 2017; Simsek et al., 2018).

Our insights are also of managerial value as the workforce of MNEs is becoming increasingly international and mobile (Fries-Tersch et al., 2018; Staples, 2007) and employees have ever more international touchpoints due to firms' intensifying involvement in international activities (P. Greve et al., 2009). Building on this process of internationalization, it is reasonable for firms to try to understand its consequences and to leverage opportunities. Our findings point to the potential within international TMTs: Internationally seasoned top managers possess a richness of specialized global knowledge, skills, and networks, which may provide valuable insights and impulses to the firm (Carpenter et al., 2001; B. B. Nielsen & Nielsen, 2011). When striving to effectively leverage this potential, implications for human resource practices may arise (Stahl et al., 2012). For example, targeted actions may be developed to transform the existent (international) human and social capital into innovative outcomes (e.g., expatriate assignments, international short-term assignments). Similarly, recruitment strategies might be adjusted to favor particularly individuals with international backgrounds and experiences.

2.6 Limitations and future research

This study is subject to several limitations that open up avenues for further research. Our study cannot disengage itself from the concerns raised about the use of demographic variables as proxies for top managers' cognition and behavior (see Lawrence, 1997). By relying on demographics, we can only assume that the TMT internationalization variable also captures characteristics that prior studies consider necessary for innovation processes, such as technological and market knowledge as well as capabilities (Smith & Tushman, 2005). Additionally, we disregard potentially existing processes and values inside the TMT that influence team dynamics and, subsequently, firms' innovativeness. While our findings suggest that TMTs *do* influence firm innovativeness, future studies could refine our understanding about *how* they do so. Interesting factors to be considered could be, e.g., team conflict, personalities, or creativity (Prasad & Junni, 2017; Somech & Drach-Zahavy, 2013). Additionally, the role of separate TMT members affecting the team could be explored, such as the CEO's leadership style or the presence of a dedicated Chief Innovation Officer (CIO) (Menz, 2012).

Our internationalization index does not only bring its strength (i.e., multidimensional depiction of internationalization) but also limitation to this study: the index is not complete and could be enriched by additional internationalization aspects, such as international experiences collected during a position in the home-country (Oxelheim et al., 2013). An additional refinement could be introduced by measuring the *intensity* of experiences, thereby distinguishing between the number of different countries and cultures, and respective lengths in which experiences were gathered. A promising approach would be to rely on cultural studies, e.g., the GLOBE study or Hofstede (1980). While we only capture the overall length of foreign experiences and partly control for cultural influences regarding TMT members' nationality, it would be interesting to investigate whether experiences from diverse countries and cultures can help explain the level of firm innovativeness.

The use of R&D intensity as a proxy for firm innovativeness also entails several limitations. In spite of its frequent use in innovation studies, critics stress that R&D only represents the budgeted resources allocated toward innovation activities and does not reflect the final innovation output (Acs & Audretsch, 1988). Similarly, the innovation process involves many different actors and inputs (Richard Adams et al., 2006), so that R&D intensity might not be a suitable proxy. Future studies could thus apply alternative measures of firm innovativeness, such as the number of patents or new products.

CHAPTER 3

Research article 2

"Of course, I can":
The association between CEO internationalization and firms' strategic risk-taking

Abstract

This study investigates whether and to what extent CEO internationalization is associated with the strategic risk-taking of firms. Combining upper echelons theory with insights from psychology and corporate governance research, we demonstrate that CEO internationalization enhances strategic risk-taking in multinational enterprises (MNEs). This association is found to be context-dependent on two important factors, which are regarded as having a moderating influence on top managers' risk-taking behavior: the CEO's variable compensation and the tenure diversity within the entire top management team (TMT). Moreover, our supplementary analysis reveals that strategic risk-taking is primarily attributable to the internationalization of the CEO but not to that of the CFO or other TMT members. Overall, this paper contributes toward a greater theoretical understanding of the implications of CEO internationalization, as well as the antecedents and boundary conditions of strategic risk-taking in MNEs.

Keywords

Upper echelons theory, CEO internationalization, strategic risk-taking, diversity, compensation

Status

The article is currently in the review process (revise & resubmit) at the journal European Management Journal (EMJ). The manuscript included in this publication is the one submitted to EMJ on May 09, 2020.

3.1 Introduction

In today's business environment, top managers are increasingly confronted with making decisions under uncertainty – a phenomenon that several authors consider to be synonymous with risk-taking (e.g., Shapira, 1995; Hoskisson et al., 2016). For instance, top managers need to make decisions about competitive actions, long-term investments (e.g., R&D) or internationalization approaches. The consequences of these choices are typically uncertain. While managerial risk-taking, defined as the "top managers' strategic choices associated with uncertain outcomes" (Hoskisson et al., 2016, p.138), is necessary to improve firm performance and to build a competitive advantage, inappropriate levels of it may have drastic consequences for firms and other stakeholders (Hoskisson et al., 2016). A comprehensive understanding of managerial risk-taking and the underlying drivers leading top managers to commit to greater risk-taking is thus of strategic importance. Nevertheless, only very little research has been done on this topic to date (Hoskisson et al., 2016).

While prior studies have regarded managerial risk-taking from various theoretical angles (for a comprehensive review, see Hoskisson et al. (2016)), research following the upper echelons tradition has sought to explain variations in managerial risk-taking by focusing on the top managers' individual backgrounds. These studies build on behavioral studies' premise that risk is subjective: Based on their unique blend of values, personality traits, feelings, and experiences, which naturally affects their subsequent choices and responses, different individuals perceive the same risk situation in different ways (e.g., Kahneman & Tversky, 1982). Against this backdrop, upper echelons scholars have associated various background characteristics of top management teams (TMTs) and/or their individual members with firm-level outcomes carrying varying levels of risk (e.g., acquisitions (Malmendier & Tate, 2015) or new product introductions (Nadkarni & Chen, 2014)). More recent studies have directly linked various background characteristics of CEOs with strategic risk-taking (i.e., a firm-level indicator), thereby placing a more holistic perspective on risk. These studies have investigated the influence of the CEO's social class (Kish-Gephart & Tochman Campbell, 2015), personality (Benischke et al., 2019), and birth order (Campbell et al., 2019) on strategic risk-taking and have emphasized the relevance of considering CEO background characteristics as a potent predictor of risk-taking in firms.

In this study, we shift the focus to CEO internationalization, which reflects the growing presence of CEOs with a foreign nationality and/or pertinent international experience (Simon-Kucher & Partners, 2019). Although a multitude of CEO characteristics have received much scholarly attention (for a comprehensive review, see Busenbark et al., 2016), relatively little

empirical research has addressed the international background of CEOs (Kunisch et al., 2019). The few existing studies have associated international CEOs with firm (financial) performance (e.g., Carpenter et al., 2001) and international strategic choices (e.g., Herrmann & Datta, 2002, 2006). Although the few studies collectively highlight that the international background of CEOs matters, our empirical understanding about its firm-level consequences remains inconclusive. In particular, we lack studies that shed light on the risk-related consequences of international CEOs. Given the rising internationalization of TMTs (Hartmann, 2015) and the fact that for CEOs, risk-taking is a key strategic decision with important implications for firms (Campbell et al., 2019), a better understanding about this association would also be of pronounced practical relevance.

With this study, we aim to contribute relevant insights about the consequences of international CEOs and specifically their relationship with strategic risk-taking. Our analysis is mainly guided by the following research questions:

1. *Is CEO internationalization associated with firms' strategic risk-taking?*
2. *Do CEO variable compensation and/or TMT diversity affect the international CEOs' influence on firms' strategic risk-taking?*

Combining upper echelons research with insights from the psychology and corporate governance literature, we theorize that the presence of international CEOs in firms is related to higher levels of strategic risk-taking because the international CEOs' global mindset and confidence gained from international experiences may lead them to engage in risky behaviors. To draw an even more fine-grained portray of CEO internationalization, we also explore moderators that may serve as governance mechanisms affecting the risk propensity of CEOs.

To test our hypotheses, we draw on a sample of multinational enterprises (MNEs) listed on the German HDAX[18] index from 2012 to 2016 and demographic data from 1270 respective management board members' profiles, of which there are 279 CEO profiles. Our results show that CEO internationalization is positively associated with a firms' strategic risk-taking. This relationship is weakened with increasing incentive-based compensation of the CEO and enhanced with rising TMT tenure diversity.

[18] The HDAX combines all 110 firms listed on the DAX30 (30 firms), MDAX (50 firms), and TecDAX (30 firms) indices and includes the most liquid and largest firms traded in the prime-standard segment of the Frankfurt Stock Exchange (STOXX Ltd., 2016).

Our study makes three main contributions. First, we extend upper echelons research by advancing our theoretical understanding of why and how managerial characteristics affect strategic decisions in firms. By investigating international CEOs, we particularly target a managerial characteristic that has attracted comparably little attention in upper echelons research so far (Kunisch et al., 2019). Consequently, we contribute toward a better understanding of CEO internationalization and highlight the significant impact international exposure may have on how CEOs frame situations and make essential decisions, such as strategic risk-taking, for their firms.

Second, we advance the literature on managerial risk-taking by combining upper echelons research with insights from the strategic management and psychology literature to explain the association between CEO internationalization and strategic risk-taking. In addition to addressing a gap in the literature, our study also draws attention to possible negative consequences of CEO internationalization, which have remained widely unexplored in the strategic management and international business (IB) literature (cf. Kunisch et al., 2019). Our analysis provides empirical evidence that CEO internationalization is associated with higher levels of strategic risk-taking. Given the equivocal nature of risk-taking as a potential curse or blessing (Hoskisson et al., 2016), this finding has important implications for practice and various research streams examining managerial risk-taking (e.g., corporate governance research or upper echelons theory).

Third, we follow scholars who stress the significance of defining conditions "that alter the impact of executive characteristics on risk-taking strategies" (Hoskisson et al., 2016, p.154) and develop theory around governance factors that prior research suggests may channel CEOs' risk-taking behavior (e.g., Finkelstein et al., 2009; Martin et al., 2013). In particular, we argue that higher levels of variable compensation lead international CEOs to engage in greater risk-taking. Additionally, we predict an overall soothing effect for TMT diversity and develop more differentiated propositions for distinct diversity dimensions (i.e., gender, age, and tenure). Overall, the analysis contributes novel insights to the vast but inconclusive literature on corporate governance mechanisms aimed at influencing the risk behavior of CEOs (Eisenhardt, 1989; Wiseman & Gomez-Mejia, 1998). By examining an explicit monetary instrument and an implicit, behavioral means, we cover a broader set of governance mechanisms and thereby contribute varied knowledge to the corporate governance, upper echelons and diversity literature. Moreover, by including TMT diversity as a moderator variable, we account for the embeddedness of the CEO in the TMT. In this way, we shed light on underlying influencing patterns within TMTs and add to the intensifying discussion about the CEO-TMT interface (Simsek et al., 2018).

3.2 Theory and hypotheses

3.2.1 International top managers' influence on firm-level outcomes

Since Hambrick and Mason's (1984) seminal article, which formed the basis of the upper echelons theory, a vast amount of studies were devoted to examine the role of top managers for decision-making and outcomes in firms. It is suggested that top managers' background characteristics, such as their values, preferences and experiences, partially predict organizational choices and outcomes (Hambrick & Mason, 1984). To proxy for underlying mental models, which form the basis for managers' perceptions, interpretations, and ultimate strategic choices, various observable individual characteristics (e.g., demographic information or character traits) have been linked with firm-level variables in prior studies (Carpenter et al., 2004; Hambrick, 2007).

Building on the ongoing internationalization of firms and their workforce, recent studies have been increasingly interested in exploring the role of top managers' internationalization for firms (e.g., Heijltjes et al., 2003; Schmid & Dauth, 2014; van Veen & Marsman, 2008). It is argued that international exposure (e.g., by living or working abroad) fundamentally impacts top managers' cognition and subsequent decision-making (B. B. Nielsen & Nielsen, 2011) and can make a bottom-line difference. For instance, executives with international experiences were associated with enhanced financial (Carpenter et al., 2000) and accounting performance (Dauth et al., 2017) as well as higher levels of firm innovativeness (Wrede & Dauth, 2020). A majority of studies also linked top managers' internationalization with firms' international involvement (e.g., Sambharya, 1996) and internationalization strategies (e.g., B. B. Nielsen & Nielsen, 2011), thereby building on the widely adopted argument that internationally seasoned managers are better equipped to deal with the complexities related to doing business in global markets (Carpenter & Fredrickson, 2001).

A small subset of studies on top managers' internationalization specifically focused on the CEO, who is the most powerful individual in the TMT and who has a disproportionate impact on TMT processes and firm outcomes according to several scholars (Cannella & Holcomb, 2005; Carmeli et al., 2011). Some of these studies particularly highlight the pronounced value of internationally experienced CEOs for firm financial performance (Carpenter et al., 2001; Daily et al., 2000). Others linked CEO international experience with global strategic choices and observed that CEO international experience is associated with higher levels of international diversification (Herrmann, 2002) and a greater propensity to choose full control entry modes (Herrmann & Datta, 2002), greenfield investments and acquisitions (Herrmann

& Datta, 2006). Despite these studies, our empirical understanding about the antecedents and consequences of CEO internationalization is far from complete (Kunisch et al., 2019).

A typically raised point in studies associating the internationalization of TMTs and CEOs with firms' international strategies is that greater levels of uncertainty and risk inhere in international involvement and that the way in which this circumstance is dealt with is significantly influenced by the international background of executives. This notion provides initial reasons to believe that a higher risk-taking propensity might exist among international executives. Nevertheless, these studies regard risk rather as a characteristic implicitly underlying specific strategic decisions in an international context (e.g., international strategic alliance formation (Lee & Park, 2008), foreign entry modes (Herrmann & Datta, 2002)) and do not directly place risk at the center of their argumentation. Considering that firms' international involvement is rather the rule than the exception and that international influences affect firms at numerous levels, we ask whether the risk-taking propensity of international CEOs is also sensible at an overall firm-level. Consequently, we focus on firms' strategic risk-taking as our outcome variable.

3.2.2 International CEOs' influence on strategic risk-taking

The risk-taking actions and behavior of managers have been key elements of strategic management research (Sitkin & Pablo, 1992). As stressed in behavioral studies, risk is subjective (Kahneman & Tversky, 1982), which implies that the way in which individuals view and respond to strategic situations is largely shaped by their personal values, attitudes and prior experiences (Hambrick & Mason, 1984). Consequently, through different theoretical lenses (e.g., agency theory, prospect theory, or the behavioral theory of the firm), a large body of research has investigated the antecedents and consequences of managerial risk-taking in firms (Hoskisson et al., 2016). Managerial risk-taking has also become a popular research object among upper echelons scholars, who relate different observable characteristics of top managers with risk-related firm outcomes. For example, prior studies have associated top managers' age or tenure with strategic change (Boeker, 1997; Wiersema & Bantel, 1992), R&D expenditure or accounting fraud (Troy et al., 2011). More recent studies have increasingly been interested in the association between risk and the CEOs' psychological traits, such as narcissism (Chatterjee & Hambrick, 2011) or overconfidence (Malmendier & Tate, 2015) (please see Hoskisson et al. (2016) for a comprehensive review). Altogether, a vast amount of studies emphasizes the significant role that top managers' different background characteristics and mental models play for risk-taking in firms.

Despite a few notable studies that associate risk-related outcomes with the international background of top managers and of CEOs in particular, our understanding about this relationship is far from complete. We hypothesize that CEO internationalization enhances firms' strategic risk-taking. To highlight the greater openness for risk among international CEOs, our reasoning focuses on three key characteristics: personality, experience and network.

a) Personality:
International CEOs are innately more self-confident and open for ambiguity

In climbing the ladder to the top of their firm, most CEOs, especially those in large firms, have made great achievements, as they were pushed through a lengthy chain of contests, during which they had to demonstrate their superior abilities and potency in order to be promoted (Hiller & Hambrick, 2005; Lazear & Rosen, 1981). Against this backdrop, scholars have sought to investigate CEOs' personality traits, which presumably helped them in their career advancement (e.g., Judge et al., 1999). For instance, Hiller and Hambrick (2005) contend that disproportionately high core self-evaluations (i.e., a construct encompassing four well-studied concepts: self-esteem, self-efficacy, locus of control, and emotional stability) are found among top managers. Whereas executives with highly positive self-evaluations may "create and seize opportunities and (…) motivate their organizations in ways that less confident executives cannot" (Hiller & Hambrick, 2005, p.298), they are also more likely to engage in uninformed or excessive risk-taking with detrimental results (Hayward & Hambrick, 1997). The authors attribute this effect to a greater conviction and belief in their abilities and a lower risk perception (Hiller & Hambrick, 2005; Wiseman & Gomez-Mejia, 1998). Additional concepts increasingly discussed in upper echelons research and significantly associated with greater managerial risk-taking include narcissism, hubris and overconfidence (Chatterjee & Hambrick, 2011; Jiatao Li & Tang, 2010; Malmendier & Tate, 2015).

In addition to basic personality traits, CEOs' international profiles may provide additional clues indicative of a greater openness for risk-taking among CEOs. In fact, working in a foreign country involves complexity and uncertainty, which stem from a possible geographic and psychic distance to the host country (Hutzschenreuter et al., 2016). This setting requires managers to be open and sensitive to the unfamiliar environment (Adler, 2002). Through their track record of international experiences (e.g., education in a foreign country, professional assignments abroad or mandates in foreign firms), CEOs have proven their global curiosity and eagerness to explore unknown, ambiguous grounds in the form of a different cultural context (Gregersen et al., 1998). This uncertainty-embracing behavior may be a sign of a more welcoming attitude toward risks.

b. Experience:

Through their international experiences, CEOs acquired greater confidence in their abilities

Although personality traits are mainly innate and acquired during an individual's formative years, certain life experiences during adulthood may trigger slight changes in an individual's personality and identity (Heatherton & Weinberger, 1994; Jiatao Li & Tang, 2010). Indeed, experiences breed trust: As experience levels increase beyond a certain threshold, decision-makers tend to overestimate their competencies in overcoming unexpected complications and to underestimate the precise risk involved in reaching success (Jemison & Sitkin, 1986; March & Shapira, 1987). Consequently, they perceive an illusion of control (Langer, 1975; Sitkin & Pablo, 1992), which may lead to bolder actions.

International experiences are considered to have a formative influence on top managers' cognition and choices (Herrmann, 2002). According to Adler (2002), through international experiences, top managers develop a "global mindset," which enables them to consider strategic business decisions from a broader perspective. Similarly, studies stress that due to their deeper understanding of foreign markets and local business practices (Herrmann & Datta, 2005), foreign top managers or those possessing international experience are better equipped to deal with the complexity and uncertainty related to global operations (B. B. Nielsen & Nielsen, 2011).

Scholars have also linked top managers' internationalization with specific international strategic decisions considered to carry greater levels of risk and uncertainty. For example, it was found that the international experience of top managers increases firms' international involvement (Sambharya, 1996) and international diversification (Tihanyi et al., 2000). Furthermore, international top managers showed a greater tendency toward engaging in international strategic alliances (Lee & Park, 2008) and foreign direct investments (B. B. Nielsen & Nielsen, 2011). The principal explanation mentioned for international top managers' greater inclination toward risky international actions is the following: Through their international experiences, these top managers developed "a sense of confidence in [their] ability to accurately estimate the [associated] risk and uncertainty" (p.191) and to effectively handle difficult cross-border operations (B. B. Nielsen & Nielsen, 2011). Risk-laden strategic options are thus perceived to entail lower risks (Carpenter & Fredrickson, 2001). The few studies investigating the implications of CEO internationalization support this notion and suggest that international experiences raise firms' propensity to commit to more risky global strategies (e.g., (Herrmann, 2002; Herrmann & Datta, 2006).

c. Network opportunities:
International CEOs can rely on a personal network that facilitates the access to valuable information, resources and opportunities

Through international experiences gathered while *growing up in a foreign country*, spending time abroad during *international education* and *professional assignments*, and holding *board mandates at foreign firms*, CEOs establish a network of personal and professional contacts, e.g., with coworkers, business partners, and customers (Herrmann & Datta, 2002; Reuber & Fischer, 1997). This global network grants the CEO access to valuable information (Herrmann & Datta, 2005), alternative viewpoints and advice (McDonald et al., 2008), which aid in improving the quality of strategic decisions in unfamiliar contexts. Additionally, these connections facilitate the access to relevant resources (Ahuja & Katila, 2004) and assist in the identification, assessment and exploitation of business opportunities (Faleye et al., 2014). Based on these network advantages, the riskiness of certain projects may be perceived as lower, reducing the CEOs' risk-aversion to investing in projects with uncertain returns (e.g., R&D). Faleye et al. (2014) also argue that better-connected CEOs benefit from reduced employment risk. Because personal networks increase the chances of re-employment in case of a job loss (Cingano & Rosolia, 2012), these CEOs have less to fear when engaging in risky choices, whose failure might lead them to losing their current occupation. Consequently, their lower perceived risk may result in greater risk-taking.

Building on the presented arguments, we expect that firms with international CEOs are more inclined toward strategic risk-taking, as reflected in larger investments that take a longer time to manifest potential returns. We hypothesize:

Hypothesis 1. *There is a positive association between CEO internationalization and firms' strategic risk-taking.*

3.2.3 Moderating effects

Managerial risk-taking is considered a double-edged sword with simultaneous upside and downside potential (Hoskisson et al., 2016). The key for sustainable value creation thus lies in finding an optimal balance between taking some risk and avoiding inappropriate amounts of it. However, what aggravates the fulfillment of this axiom are the conflicts of interest and diverging strategic objectives that may result when the risk preferences of managers and a firm's various stakeholders differ (Filatotchev & Wright, 2011). This phenomenon has been formally captured by *agency theory* (Eisenhardt, 1989), which addresses the alignment of the often diverging risk preferences of principals (e.g., shareholders) and agents (e.g., CEOs).

Given the ambivalent nature of risk, an important question emerging for firms is how to ensure that top managers make (risk-related) decisions in the best interest of the firm. Two seemingly opposing expectations underlie this notion: 1) Firms want their top managers to take risks to reap the possible higher returns associated with greater risk-taking; 2) Firms want top managers to refrain from opportunism and value-destroying risk behavior (Sanders & Hambrick, 2007).

The corporate governance literature proposes numerous mechanisms that influence managers' choices and foster appropriate managerial risk-taking. For example, incentives (e.g., performance-based compensation) and monitoring by the supervisory board or firm owners (e.g., block holders) are commonly suggested governance instruments to align the risk preferences of managers and the firm's shareholders (Hoskisson et al., 2016). Beyond these formal structures, informal (i.e., behavioral) structures and processes – such as power differentials and decision-making processes in executive teams – also play an important role in corporate governance (Hambrick et al., 2008).

In our study, we focus on two aspects that prior research found to affect managers' risk-taking behavior. First, following consistent calls for research that integrates upper echelons theory with executive compensation theory (Benischke et al., 2019; Hambrick, 2007), we investigate the role of the CEO's variable compensation as a moderator of international CEOs' risk-taking behavior (Martin et al., 2013). Compensation has been a key topic in corporate governance and executive research, and studies have shown that executive financial incentives significantly influence firm behavior (e.g., Hambrick, 2007; P. Kumar & Zattoni, 2016; Sanders, 2001). Additionally, among the many formal governance mechanisms suggested to align shareholder and managerial interests, executive compensation is one of the most intensively studied mechanisms (Hoskisson et al., 2016; P. Kumar & Zattoni, 2016). Second, we account for the social context of the CEO by introducing as a moderating variable the TMT, specifically, the diversity within the TMT (Finkelstein & Hambrick, 1996). Recent research has suggested that fellow TMT members may take on a monitoring role and limit the CEO's choices (Tang, 2017). To obtain an even more fine-grained understanding of this effect, we focus on the diversity within the TMT (Finkelstein & Hambrick, 1996), which has been a key concern in upper echelons research and is assumed to significantly affect decision-making processes in TMTs (S. Nielsen, 2010a). Since the CEO is embedded in the TMT, we expect that TMT diversity may affect the CEO's risk behavior.

By investigating not only a common incentive instrument (i.e., the variable compensation of the CEO) but also the CEO's social context (i.e., TMT diversity), we take a more varied perspective on managerial risk-taking. In this way, we partially account for the complexity involved in explaining managerial behavior, that is, explaining top managers' motivation to engage is risky behaviors (Finkelstein et al., 2009; Hambrick et al., 2008). In the following, the distinct mechanisms of our moderating variables with regard to risk will be explained in more detail.

3.2.3.1 CEO compensation

Agency theory claims that the risk preferences of principals (e.g., shareholders) and agents (e.g., CEOs) typically diverge (Eisenhardt, 1989). Whereas principals can spread their wealth and risk across multiple firms, agents are usually tied to a single firm and thus unable to effectively diversify their employment and compensation risk (Devers et al., 2008; Eisenhardt, 1989). Consequently, unlike principals who are risk-neutral and interested in maximizing returns, agents are assumed to prefer risk-averse actions (Wright et al., 2007). To align risk preferences and alleviate the CEOs' risk aversion, agency theory proposes various governance mechanisms, such as performance-based compensations (Hoskisson et al., 2016).

In line with agency theory and several European corporate governance codes (e.g., German Corporate Governance Code (GCGC, 2019)), it is suggested that top managers' compensation packages should include an outcome-based portion (Jensen & Murphy, 1990) that is determined by the achieved performance and partly open to the influence of top managers (Schmid & Wurster, 2016). Hence, firms typically award their top managers with compensation packages consisting of a fixed part, which is based on the expected responsibilities, tasks and performance, and a variable part. To incentivize managers to take more risk and thus fulfill the expectations of shareholders, a larger amount is allocated toward variable compensation. Numerous studies empirically support this practice and posit that a higher proportion of variable incentives tends to enhance top managers' risk-taking (Martin et al., 2013; Wright et al., 2007).

Top management internationalization has also been associated with greater variable compensation. According to Schmid and Wurster (2016), international top managers possess valuable human capital, which enables them to better serve their principals in achieving their objectives. To take advantage of this potential and to provide incentives toward greater risk-taking, a larger amount of performance-based compensation is given to international top managers.

Building on the risk-inducing nature of variable compensation, we theorize that higher levels of it incentivize international CEOs to take even more risk. Accordingly, we expect that variable compensation accentuates the anticipated greater risk-taking propensity among international CEOs. Formally, we hypothesize the following:

Hypothesis 2. *In the context of greater CEO variable compensation, the positive association between CEO internationalization and firms' strategic risk-taking will be amplified.*

3.2.3.2 TMT diversity

Recent research in the upper echelons field emphasizes the interrelation between the CEO and the other TMT members (e.g., Georgakakis et al., 2017; Heyden et al., 2015). Although the CEO is assumed to hold disproportionate power in the TMT and to make the ultimate decisions, scholars claim that the other TMT members support him/her in formulating strategies (Cao et al., 2010)[19]. Consequently, the TMT plays a significant role in influencing the CEO's preferences, decisions and investment behaviors (Heyden et al., 2015). Expecting that the risk behavior of international CEOs is also influenced by the social context and specifically that comprising their fellow TMT members, we account for this cross-level interaction by including TMT diversity as a moderator variable in our model. While diversity within corporate boards has received increased attention from politics and the media in recent years (e.g., regarding gender quotas), it is also a key concern in upper echelons research (Carpenter et al., 2004).

An often-raised argument is that diversity has the potential to enhance decision-making in firms, because the available variety of perspectives in the TMT allows for a more comprehensive and critical evaluation of different situations and alternatives (Bantel & Jackson, 1989; Rivas, 2012). Indeed, final decisions of teams reflect the oftentimes opposing viewpoints, abilities and judgments of its members (Sah & Stiglitz, 1986, 1991). To reconcile these differences and reach a consensus, compromises are made, resulting in less extreme and less risky outcomes (Kogan & Wallach, 1966; Sah & Stiglitz, 1991). The likelihood that risky projects and strategies are being accepted is thus lower, because different group members first need to give their approval (S. Cheng, 2008). In line with this notion, TMT diversity has been associated with reduced risk (Perryman et al., 2016) and superior performance (Bernile et al.,

[19] This notion is in line with the German Corporate Governance Code, which "presents essential statutory regulations for the management and supervision of German listed companies". In 'Principle 1' it is declared that "The Management Board is responsible for managing the enterprise in the enterprise's best interests. Its members are jointly accountable for managing the enterprise. The Chair or Spokesperson of the Management Board coordinates the work of the Management Board members." (German Corporate Governance Code, 2019)

2018). Despite a large volume of empirical studies, inconsistent findings leave the question open regarding the actual benefits and implications of diversity in top managers' backgrounds (Cannella et al., 2008; Días-Fernández et al., 2020; S. Nielsen, 2010a).

Since TMT diversity is a multifaceted construct (Williams & O'Reilly, 1998) with varying implications of its underlying dimensions, in our model, we include three distinct diversity variables that we believe might alter the association between CEO internationalization and strategic risk-taking (i.e., gender, age, and tenure diversity). All variables represent key diversity dimensions in upper echelons research (S. Nielsen, 2010a). Overall, we suggest that as a control mechanism, compared to explicit control mechanisms, diversity may act as a more subtle, implicit means to influence the CEOs' risk-taking behavior.

TMT gender diversity

A large consensus exists in the literature that risk-taking may vary by gender (MacCrimmon & Wehrung, 1986), with women generally being more risk-averse than men (Jianakopolos & Bernasek, 1998). This tendency is also observable in a business context. For instance, Elsaid and Ursel (2011) found that risk-taking is decreased when a male CEO is succeeded by a female. The growing representation of females on TMTs also led scholars to investigate the implications of gender diversity in upper echelons (i.e., TMTs consisting of both males and females) for firm risk. Their findings reveal that higher levels of TMT gender diversity are associated with enhanced monitoring processes (R. B. Adams & Ferreira, 2009), more comprehensive evaluations of strategic choices (Upadhyay & Zeng, 2014), less fraudulent business practices (Wahid, 2019) and lower firm risk (Perryman et al., 2016). It is argued that if female top managers are inclined toward strategic choices of more prudent risk, they are likely to express their opinions and try to convince fellow TMT members to follow suit (Perryman et al., 2016). On this basis, scholars even consider gender diversity in the TMT as a substitute means for weak corporate governance (Gul et al., 2011). Since the CEO is embedded in the TMT, we argue that gender-diverse TMTs, which are assumed to make less risky choices than those made by homogeneous TMTs[20], moderate their international CEOs' choices, especially their risk-taking propensity. Consequently, we hypothesize the following:

Hypothesis 3a. *In the context of a higher level of gender diversity in the TMT, the positive association between CEO internationalization and firms' strategic risk-taking will be weaker.*

[20] We acknowledge that homogeneous teams can consist of either males or females, which implies differing risk preferences for homogeneous teams based on their specific gender group. Nevertheless, the number of females in the TMTs of German firms listed on the *HDAX* is still rather low; currently, no TMT exists that is composed of only females. In our sample, the highest percentage of females in a TMT is 40%, which translates into a gender diversity (i.e., Blau index) score of 0.48.

TMT age diversity

The framing and processing of information is also affected by an individual's age. In fact, younger top managers are generally considered less risk-averse and more open for change and novelties (Barker & Mueller, 2002; Herrmann & Datta, 2005; Wiersema & Bantel, 1992). Whereas younger top managers still need to build their reputation and thus are more willing to make riskier choices that may be beneficial for their careers, older executives nearing retirement tend to avoid risky investments in order to maintain a legacy of success and personal wealth (Heyden et al., 2015; Matta & Beamish, 2008). In contrast, older top managers can rely on a richer experience and knowledge base and a broader network, which both have been accumulated over a longer period. These may help them to make more comprehensive assessments of situations and to deal with risks (Faleye et al., 2014; Wiersema & Bantel, 1992).

Overall, an age-diverse TMT unites the general life experiences, skills and generational perspectives of individuals from varying age groups. This broad range of perceptions and experiences may enable a more comprehensive assessment about situations and, through the team-based synthesis of possibly diverging age-specific judgments, may likely result in less extreme choices (Heyden et al., 2015; Ji Li et al., 2011). This notion is reinforced by the different aged individuals' seemingly distinct risk-taking propensities, which need to be reconciled when making decisions. Since decision-making at the top of firms involves the interaction of both the CEO and other TMT members (Simsek et al., 2018), we assume that the generally more prudent choices of age-diverse TMTs influence the CEOs sense-making and decisions. Accordingly, we expect that the risk-taking behavior of an international CEO will decrease with a rising degree of TMT age diversity and capture this in the following hypothesis:

Hypothesis 3b. *In the context of a higher level of age diversity in the TMT, the positive association between CEO internationalization and firms' strategic risk-taking will be weaker.*

TMT tenure diversity

The length of managers' tenure in a firm fundamentally influences their perspective and decision-making. Scholars assert that due to the psychological and tangible investment they develop in a firm (Simsek, 2007), with growing tenure, top managers become less open to change (Finkelstein & Hambrick, 1996) and more risk-averse (D. Miller & Shamsie, 2001). Similarly, experiences within a firm foster the adoption of a shared vocabulary and the development of similar interpretations of events and clear role expectations, thereby easing the interactions within TMTs (Heyden et al., 2015; Wiersema & Bantel, 1992). Moreover,

within the firm and with other external stakeholders, long-tenured top managers may have developed a broad network (Heyden et al., 2015), which may serve as a valuable source of information and aid in evaluating strategic options. In aggregate, tenure-diverse TMTs (i.e., TMTs comprising executives with differing lengths of tenure in the firm) comprise a range of distinct opinions, knowledge and risk preferences that its members have developed throughout the course of their affiliation to the firm. In line with diversity studies (e.g., S. Nielsen, 2010a), this broad array of cognitive resources may lead to better decision-making (L. R. Hoffman & Maier, 1961) and a "culture of questioning" (Wahid, 2019, p.708). Since decisions in diverse teams tend to be more moderate and represent the average of individual judgments (S. Cheng, 2008; Kogan & Wallach, 1966), we infer that individual TMT members' extreme opinions (e.g., extreme opinions regarding risk-taking) will be restrained. Consequently, we expect that the international CEOs' risk-taking propensity weakens with a growing tenure diversity of its surrounding TMT members. Consequently, we hypothesize:

Hypothesis 3c. *In the context of a higher level of tenure diversity in the TMT, the positive association between CEO internationalization and firms' strategic risk-taking will be weaker.*

3.3 Methodology

3.3.1 Sample and data collection

For our empirical analysis, we draw on a sample of firms listed on the German HDAX index. Germany appears to be a suitable sampling frame, because internationalization has particularly advanced in German upper echelons (Hartmann, 2015). Moreover, the German Corporate Governance Code (GCGC, 2019) and German trade law require stock-listed firms to assess and, in their annual report, transparently report on their risk situation. Firms thus need to discuss their expected future development, assess corresponding risks and opportunities, and outline approaches on how to systematically handle risks (§289 Inhalt des Lageberichts, 2019). Because it is the *management board*'s ('Vorstand') responsibility to ensure adequate risk management and control in the firm (§289 Inhalt des Lageberichts, 2019), firms' risk-taking strategies represent a conscious choice of top managers.

We analyze the association between CEO internationalization and firm strategic risk-taking in the years 2012-2016[21]. Our sample is the result of an extensive data collection process. Initially

[21] Exceptions are models 13 and 14 (Table 11) where the time period extends to year 2017 (i.e., t+2).

focusing on the 110 firms listed on the HDAX in June 2016, we removed 16 firms belonging to the banking, insurance, and real estate industries, which are considered less research-intensive industries (Zentrum für Europäische Wirtschaftsforschung, 2017). Since our dependent variable encompasses firms' R&D expenses, their systematic nonexistence could have distorted our findings. The respective management board members of the remaining firms were then identified via the firms' annual reports. In-depth analyses of curriculum vitae (CVs), firm websites and other public online profiles subsequently served as valuable sources for top managers' demographic information. By relying on bibliographic data, we follow an approach that is typical in upper echelons research (S. Nielsen, 2010a). The data on top managers was eventually complemented with firm-level data from the database Thomson ONE Banker. Last, we excluded 38 firms that were inactive in a research-intensive industry[22] and/or whose data profiles were incomplete. The final sample includes 56 firms and demographic data on 359 different TMT members, i.e. 1270 "top manager profile-years" and 279 "CEO profile-years".

3.3.2 Dependent variable: Strategic risk-taking

Within upper echelons research, risk has typically been captured by single-dimension measures, such as foreign entry mode (B. B. Nielsen & Nielsen, 2011) or the number of international strategic alliances (Lee & Park, 2008). Aiming to regard risk-taking from a more holistic firm-level perspective, we measure risk-taking via a three-component indicator that was employed in previous studies investigating the antecedents of strategic risk in firms (e.g., Benischke et al., 2019; Devers et al., 2008; Kish-Gephart & Tochman Campbell, 2015). The index builds on three firm-specific variables that various scholars claim to reflect firms' strategic risk (cf. Ahuja et al., 2008; K. D. Miller & Bromiley, 1990): R&D expenditures (annual expense in a given year on R&D), capital expenditures (spending on property, plant, and equipment), and long-term debt (debt with maturity beyond one year held on the balance sheet). Each indicator was measured in millions of dollars. Given that each component represents a long-term investment, whose consequences only materialize in the long-run, they are all regarded to carry heightened levels of risk (K. D. Miller & Bromiley, 1990). A higher variable score thus means higher strategic risk. To arrive at a single factor, we perform a Principal Component Analysis by using the unscaled version of each variable. The resulting single indicator explains 88.6 percent of the variance and has an Eigenvalue of 2.6579. The

[22] Industries with a one-digit SIC code of 2, 3 or 4 are considered research-intensive (i.e., manufacturing, transportation, communications, electric, gas & sanitary services) (Rammer et al., 2017). This research scope aligns with the study of Martin et al. (2013), which employs the same composite for strategic risk-taking.

respective factor loadings are 0.5536 (R&D expenditure), 0.5956 (long-term debt) and 0.5821 (capital expenditure).

By using the unscaled versions of the variables and explicitly controlling for firm size in our models (represented by the variables *employees* and *sales*), we avoid potential concerns related to spurious correlations, which are common to ratio measures (Wiseman, 2006). The use of a one-year time lag between the regressors and the measurement of the outcome variable (i.e., strategic risk-taking measured at time t+1) ensures the temporal sequence of our hypothesized relationship and thereby addresses potential reverse-causality issues.

3.3.3 Independent variable: CEO internationalization

To measure top managers' internationalization, recent research recommends employing multidimensional constructs instead of relying only on single items (e.g., Oxelheim et al., 2013). Building on prior research (e.g., Dauth et al., 2017; Schmid & Wurster, 2016), we calculate an index for each CEO that encompasses four internationalization dimensions: (i) nationality, (ii) international education, (iii) international work experience, and (iv) international board appointments. Overall, these factors capture the essential phases of an individual's life and career, during which defining international experiences and knowledge are gathered (Hambrick et al., 1998; Norris & Gillespie, 2009). The index is calculated as follows:

$$\text{INT} = 1/4 \left(F_i + (1 - 1/E_i{+}1) + (1 - 1/W_i{+}1) + (1 - 1/A_i{+}1)\right) \qquad (1)$$

F_i represents the foreignness of person i relative to a firm's home country (i.e., F_i = 0 if the person's nationality is German; F_i = 1 for any other nationality). E_i is the number of years of higher education spent abroad. W_i is the number of years of international work experience. A_i is the number of appointments to the boards of foreign firms.

3.3.4 Moderator variables

CEO compensation

The German Executive Compensation Disclosure Act ('Vorstandsvergütungs-Offenlegungsgesetz') requires stock-listed firms to report information regarding the compensation of individual top executives. This obligation enables us to collect relevant compensation data from firms' remuneration reports. Following Schmid and Wurster (2016), we differentiate between *CEO fixed compensation* and *CEO variable compensation*. Fixed compensation comprises a CEO's basic compensation (e.g., salary) and benefits (e.g., company

car usage), which are determined ex-ante. Variable compensation encompasses all compensation components that are performance-based and determined ex-post, i.e., compensation based on key performance figures and equity-based compensation.

TMT diversity

To model *TMT gender diversity*, we rely on the commonly employed Blau (1977) heterogeneity index. It is computed as $(1-\sum p_i^2)$, where p_i is the proportion of TMT members in the *i*th category. As there are two categories (i.e., male and female) in our case, diversity is maximized at an index value of 0.5; values close to 0 imply that one gender dominates the TMT. For *TMT age diversity* and *TMT tenure diversity*, we follow prior studies (e.g., Allison, 1978; Cannella et al., 2008; Murray, 1989) and measure the variables as their respective coefficients of variation (i.e., standard deviation divided by mean). Lower values reflect higher homogeneity (Jaw & Lin, 2009). All diversity variables comprise the entire TMT (i.e., CEO and remaining TMT members) as listed in the corresponding annual reports.

3.3.5 Control variables

We control for several variables that may represent alternative explanations for enhanced strategic risk-taking in firms. At the CEO-level, we control for *CEO age*, because the risk perception and risk-taking propensity of individuals may differ by age (Herrmann & Datta, 2005). Prior research claims that older top managers are more risk-averse and highly value career stability and security (Hambrick & Mason, 1984; Matta & Beamish, 2008). We also include *CEO tenure*, which reflects the number of years that a CEO has spent at the respective organization. It is suggested that due to the psychological and tangible investment in a firm (Simsek, 2007), longer tenure may result in greater risk avoidance and aversion (D. Miller & Shamsie, 2001). Moreover, we control for the CEO's level of education. According to Wiersema and Bantel (1992), top managers with higher levels of education are more likely to engage in risky strategic actions. To compute *CEO education*, we rely on the coding scheme as employed by Georgakakis et al. (2017), which assigns the following values: 1 = no academic degree; 2 = Bachelor's degree; 3 = Master's degree; 4 = MBA degree; and 5 = PhD degree or equivalent.

At the TMT-level, we control for *TMT size*. It is measured as the number of TMT members as stated in the annual report of the respective year. The larger the team is, the higher the likelihood to find heterogeneity at various levels and the lower the volatility when measuring team-specific items (Tihanyi et al., 2000). Additionally, decision-making in large teams often leads to compromises, resulting in more moderate decisions and less risky outcomes (S. Cheng, 2008).

We also control for various firm-specific effects. To account for potential effects on risk-taking caused by corporate size (Wright et al., 2007), we add the variables *Sales* and *Employees* to our models[23]. The variable *Sales* indicates the net sales in the year under consideration. *Employees* denotes the total number of employees of a firm in a given year. Finally, we include the variable return on assets (*ROA*) to control for firm performance (Bromiley, 1991). It is argued that firms with a higher profitability are more likely to invest in more risky long-term projects (e.g., R&D) (Barker & Mueller, 2002; Hundley et al., 1996).

3.3.6 Analytical approach

Given the panel nature of our dataset, we tested our hypotheses with a fixed effects estimator. Because panel data models estimated with ordinary least squares (OLS) are often prone to heteroscedastic error terms and autocorrelation, fixed or random effects models are frequently employed (Certo & Semadeni, 2006). The decision between a fixed or random effects model thereby depends on the estimated error term and whether it is correlated with the independent variables (Wooldridge, 2010). A Hausman (1978) specification test indicated that a fixed effects model, i.e., the more conservative approach to analyze panel data (S. Nielsen, 2010a), is appropriate in our case. Consequently, firm-specific as well as time fixed effects are included in all specifications.

3.4 Results

3.4.1 Results of the main analysis

The descriptive statistics of the variables are provided in Table 7. Table 8 shows the associated correlation coefficients.

[23] The variables are included in their normal functional form. Additional estimations with logged variables obtained the same results.

Table 7: Descriptive statistics of the main variables

Variables	Obs[24]	Mean	Std. Dev.	Min	Max
Strategic risk-taking$_{t+1}$	280	2.900[25]	1.630	-0.817	9.208
CEO internationalization	279	0.333	0.283	0	1.991
Rest TMT internationalization	280	0.281	0.187	0	0.757
CFO internationalization	280	0.252	0.221	0	0.859
CEO fixed compensation	248	1.029	0.516	0.208	2.276
CEO variable compensation	248	2.458	2.393	0	16.352
Rest TMT fixed compensation	245	0.628	0.271	0.167	1.804
Rest TMT variable compensation	245	1.305	1.168	0	6.971
CFO fixed compensation	254	0.628	0.317	0	2.406
CFO variable compensation	249	1.284	1.136	0	7.467
CEO age	279	54.312	5.643	42	72
CEO tenure	279	16.025	9.416	1	39
CEO education	279	3.939	1.193	1	5
TMT size	280	4.536	1.796	2	10
TMT gender diversity	280	0.056	0.122	0	0.480
TMT age diversity	280	0.101	0.046	0	0.241
TMT tenure diversity	280	0.579	0.292	0	1.646
Sales	280	20.261	36.860	0.052	213.292
Employees	280	59.040	101.482	0.299	610.076
ROA	280	5.351	4.978	-22.314	22.960

[24] Please note that data for all variables was not always fully available for all firms for the period under consideration. Consequently, the number of observations differs across the different variables.

[25] Multiplied by 10^9.

Table 8: Pearson-Spearman correlations among the main regression variables

	Strategic risk-taking$_{t+1}$	CEO internationa-lization	Rest TMT internationa-lization	CFO internationa-lization	CEO fixed compen-sation	CEO variable compens ation	Rest TMT fixed compen-sation	Rest TMT var. compen-sation
Strategic risk-taking$_{t+1}$	1							
CEO internationalization	-0.079	1						
Rest TMT internationalization	0.139**	0.285***	1					
CFO internationalization	0.07	0.254***	0.757***	1				
CEO fixed compensation	0.595***	0.057	0.242***	0.134**	1			
CEO variable compensation	0.788***	-0.082	0.215***	0.088	0.622***	1		
Rest TMT fixed compensation	0.606***	0.092	0.200***	0.102	0.833***	0.614***	1	
Rest TMT var. compensation	0.637***	-0.063	0.210***	0.1	0.540***	0.855***	0.611***	1
CFO fixed compensation	0.570***	0.104*	0.129**	0.059	0.778***	0.539***	0.916***	0.530***
CFO variable compensation	0.713***	-0.055	0.177***	0.046	0.557***	0.896***	0.621***	0.916***
CEO age	0.318***	-0.198***	0.146**	0.029	0.422***	0.449***	0.294***	0.389***
CEO tenure	0.332***	-0.209***	0.056	0.103*	0.254***	0.222***	0.163**	0.142**
CEO education	0.217***	0.083	0.175***	0.073	0.093	0.249***	0.196***	0.239***
TMT size	0.655***	0.02	0.331***	0.223***	0.579***	0.598***	0.622***	0.544***
TMT gender diversity	0.218***	-0.023	-0.024	-0.026	0.136**	0.096	0.199***	0.126**
TMT age diversity	-0.067	-0.184***	-0.107*	-0.064	-0.045	-0.017	-0.019	-0.051
TMT tenure diversity	-0.036	-0.132**	-0.056	-0.120**	-0.04	-0.017	-0.019	-0.096
Sales	0.933***	-0.088	0.152**	0.099*	0.610***	0.763***	0.622***	0.614***
Employees	0.883***	0.026	0.184***	0.160***	0.633***	0.748***	0.637***	0.606***
ROA	-0.078	-0.108*	0.027	-0.008	-0.068	0.058	-0.065	0.094

Table 8: Pearson-Spearman correlations among the main regression variables (continued)

	CFO fixed compen-sation	CFO variable compen-sation	CEO age	CEO tenure	CEO education	TMT size	TMT gender diversity	TMT age diversity	TMT tenure diversity	Sales	Emplo-yees	ROA
CFO fixed compensation	1											
CFO variable	0.588***	1										
CEO age	0.242***	0.401***	1									
CEO tenure	0.123*	0.140**	0.398***	1								
CEO education	0.188***	0.266***	0.052*	0.02	1							
TMT size	0.579***	0.587***	0.289***	0.281***	0.170***	1						
TMT gender diversity	0.189***	0.126**	-0.05	0.1	0.064	0.348***	1					
TMT age diversity	-0.06	-0.06	0.05	0.09	-0.036	-0.02	-0.043	1				
TMT tenure diversity	-0.01	-0.07	0.084	-0.180***	-0.084	0.052	0.064	-0.012	1			
Sales	0.590***	0.686***	0.286***	0.288***	0.247***	0.664***	0.243***	-0.074	-0.04	1		
Employees	0.579***	0.677***	0.281***	0.237***	0.174***	0.690***	0.222***	-0.035	-0.008	0.856***	1	
ROA	0.020	0.116*	-0.094	0.084	0.041	0.010	-0.092	0.144**	-0.246***	-0.130**	-0.084	1

Notes: *** p < 0.01, ** p < 0.05, * p < 0.10

The results of our primary analysis are presented in Table 9. To observe the incremental changes in variance explained across various estimation models, we first regress *strategic risk-taking* on the control variables only (Model 0). The results of our main analysis are presented in Model 1. The overall explanatory power of approximately 91% suggests a good fit of our model specification. The estimation of a model that includes all interaction terms allows taking conditional dependencies between direct effect coefficients and moderating effect coefficients into account and therefore isolates the individual effect of each term (Ming Li et al., 2018). By adding all contingency factors in Model 1 and using this specification as our basis for interpretation, we are thus able to observe the "pure" effect of *CEO internationalization*.

Table 9: Results of the analysis with strategic risk-taking$_{t+1}$ as the dependent variable

		Strategic risk-taking$_{t+1}$		
		- Base model -		
	(0)	(1)	(2)	(3)
VARIABLES	**Control variables**	**CEO**	**TMT**	**CEO + CFO**
CEO internationalization		0.577***	0.641***	0.591***
		(0.203)	(0.223)	(0.211)
Rest TMT internationalization			0.142	
			(0.157)	
CFO internationalization				-0.143
				(0.097)
CEO fixed compensation		-0.076	-0.089	-0.080
		(0.063)	(0.069)	(0.066)
CEO variable compensation		0.076**	0.075**	0.080**
		(0.031)	(0.030)	(0.032)
CEO internationalization		0.191	0.136	0.177
× CEO fixed comp.		(0.153)	(0.163)	(0.154)
CEO internationalization		-0.186**	-0.178**	-0.182***
× CEO variable comp.		(0.070)	(0.070)	(0.068)
Rest TMT fixed compensation			0.119	
			(0.119)	
CFO fixed compensation				0.055
				(0.084)
Rest TMT variable compensation			-0.007	
			(0.016)	
CFO variable compensation				-0.019
				(0.034)
TMT gender diversity		0.467**	0.490**	0.451**
		(0.199)	(0.202)	(0.199)
TMT age diversity		-0.404	-0.622	-0.308
		(0.378)	(0.394)	(0.408)
TMT tenure diversity		0.299***	0.324***	0.279**
		(0.111)	(0.107)	(0.113)
CEO internationalization		-0.509	-0.568	-0.543
× TMT gender diversity		(0.435)	(0.414)	(0.446)
CEO internationalization		-0.666	-0.170	-1.084
× TMT age diversity		(1.391)	(1.236)	(1.490)
CEO internationalization		-0.457**	-0.501**	-0.391*
× TMT tenure diversity		(0.189)	(0.208)	(0.206)
CEO age	0.004	0.005	0.006*	0.005
	(0.004)	(0.004)	(0.004)	(0.004)

Table 9: Results of the analysis with strategic risk-taking$_{t+1}$ as the dependent variable (continued)

⋮				
CEO tenure	0.006*	0.007***	0.007***	0.007***
	(0.003)	(0.002)	(0.002)	(0.002)
CEO education	0.058	0.059*	0.055*	0.059*
	(0.038)	(0.031)	(0.032)	(0.031)
TMT size	-0.011	-0.028	-0.022	-0.027
	(0.020)	(0.017)	(0.018)	(0.017)
Sales	0.032***	0.030***	0.030***	0.030***
	(0.008)	(0.010)	(0.010)	(0.010)
Employees	0.003	0.003	0.003	0.003
	(0.004)	(0.004)	(0.004)	(0.004)
ROA	0.002	0.005**	0.006**	0.005**
	(0.008)	(0.010)	(0.010)	(0.010)
Constant	-1.330***	-1.605***	-1.762***	-1.555***
	(0.317)	(0.281)	(0.308)	(0.275)
Observations	279	248	244	247
R^2 within	0.545	0.632	0.643	0.635
R^2 between	0.899	0.906	0.905	0.905
R^2 overall	0.894	0.905	0.903	0.904
F	25.33***	29.00***	31.95***	35.28***

Notes: *** p < 0.01, ** p < 0.05, * p < 0.10; robust standard errors in parentheses

Hypothesis 1 predicted that international CEOs are associated with higher strategic risk-taking. In line with our main argumentation, we find a positive and statistically significant association of *CEO internationalization* and *strategic risk-taking* (ß = 0.577; p < 0.01). Hence, Hypothesis 1 is supported.

Hypothesis 2 expected a moderating effect of international CEOs' variable compensation. While finding a significantly positive direct coefficient of *CEO variable compensation* (ß = 0.076; p < 0.05), the coefficient of the interaction between *CEO internationalization* and *CEO variable compensation* is negative and significant (ß = -0.186; p < 0.05). The latter estimate opposes our prediction of a positive moderating effect of the CEO's variable compensation: In the context of higher variable compensation, the association between *CEO internationalization* and *strategic risk-taking* is weakened instead of amplified. Consequently, hypothesis 2 is not supported.

Hypotheses 3a, 3b and 3c predicted that different kinds of diversity each reduce the positive association between the CEO's internationalization and strategic risk-taking. Support for this

prediction is only partially obtained. While we estimate consistently the expected negative coefficients for the moderating effects, they are neither significant for *TMT gender diversity* (ß = -0.509; p > 0.1) nor for *TMT age diversity* (ß = -0.666; p > 0.1). Hence, hypotheses 3a and 3b are not supported. Interestingly though, we observe a significant and positive direct effect of *TMT gender diversity* on *strategic risk-taking* (ß = 0.467; p < 0.05). For the moderating effect of *TMT tenure diversity*, we find a significantly negative coefficient (ß = -0.457; p < 0.05). Hypothesis 3c is thus supported. The direct association of this diversity dimension with *strategic risk-taking* is also significantly positive (ß = 0.299; p < 0.01).

Beyond the main variables of interest, we find additional significant and positive associations for the CEO-specific variables *CEO tenure* (ß = 0.007; p < 0.01) and *CEO education* (ß = 0.059; p < 0.1). Significant positive effects are also estimated for the firm size (*Sales*) (ß = 0.030; p < 0.01) and firm performance (*ROA*) (ß = 0.005; p < 0.05).

3.4.2 Robustness checks

Our argumentation suggests that firms with international CEOs engage in more strategic risk-taking. To verify the robustness of our findings, we conduct various additional tests by changing the specification of our models. In a first set of estimations, we removed the moderator variables. For each moderator group (i.e., compensation and diversity), in order to test if our effects of the direct coefficients are conditional on single or groups of moderating terms, the variables were excluded first separately and then altogether. The results are presented in Table 10, Models 4-10.

Table 10: Robustness checks (Part I)

	***Strategic risk taking*$_{t+1}$**				
VARIABLES	**(0)**	- Base model - **(1)**	**(4)**	**(5)**	**(6)**
CEO internationalization		0.577***	0.794***	0.497**	0.312
		(0.203)	(0.289)	(0.203)	(0.205)
CEO fixed compensation		-0.076	-0.016	0.028	-0.012
		(0.063)	(0.033)	(0.044)	(0.035)
CEO variable compensation		0.076**	0.069**	0.016	0.017
		(0.031)	(0.028)	(0.014)	(0.014)
CEO internationalization × CEO fixed comp.		0.191		-0.130	
		(0.153)		(0.088)	
CEO internationalization × CEO variable comp.		-0.186**	-0.167***		
		(0.070)	(0.059)		
TMT gender diversity		0.467**	0.421**	0.306	0.330
		(0.199)	(0.190)	(0.198)	(0.201)
TMT age diversity		-0.404	-0.408	-0.449	-0.449
		(0.378)	(0.368)	(0.403)	(0.410)
TMT tenure diversity		0.299***	0.319***	0.309**	0.293**
		(0.111)	(0.118)	(0.122)	(0.119)
CEO internationalization × TMT gender diversity		-0.509	-0.270	-0.279	-0.457
		(0.435)	(0.378)	(0.484)	(0.459)
CEO internationalization × TMT age diversity		-0.666	-0.565	-0.098	-0.134
		(1.391)	(1.386)	(1.526)	(1.543)
CEO internationalization × TMT tenure diversity		-0.457**	-0.514**	-0.535**	-0.494**
		(0.189)	(0.200)	(0.220)	(0.220)
CEO age	0.004	0.005	0.004	0.006	0.006
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
CEO tenure	0.006*	0.007***	0.007***	0.007**	0.007**
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
CEO education	0.058	0.059*	0.059*	0.052	0.051
	(0.038)	(0.031)	(0.031)	(0.038)	(0.039)
TMT size	-0.011	-0.028	-0.028	-0.019	-0.017
	(0.020)	(0.017)	(0.018)	(0.021)	(0.021)
Sales	0.032***	0.030***	0.030***	0.032***	0.032***
	(0.008)	(0.010)	(0.010)	(0.009)	(0.009)
Employees	0.003	0.003	0.003	0.002	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ROA	0.002	0.005**	0.005**	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Constant	-1.330***	-1.605***	-1.626***	-1.580***	-1.561***
	(0.317)	(0.281)	(0.281)	(0.329)	(0.335)
Observations	279	248	248	248	248
R^2 within	0.545	0.632	0.630	0.589	0.587
R^2 between	0.899	0.906	0.904	0.898	0.898
R^2 overall	0.894	0.905	0.903	0.896	0.896
F	25.33***	29.00***	26.56***	22.88***	16.69***

Notes: *** p < 0.01, ** p < 0.05, * p < 0.10; robust standard errors in parentheses

Table 10: Robustness checks (Part I) (continued)

	Strategic risk taking$_{t+1}$			
VARIABLES	**(7)**	**(8)**	**(9)**	**(10)**
CEO internationalization	0.581***	0.543**	0.343**	0.198
	(0.209)	(0.207)	(0.168)	(0.153)
CEO fixed compensation	-0.058	-0.077	-0.087	-0.073
	(0.055)	(0.064)	(0.065)	(0.056)
CEO variable compensation	0.073**	0.075**	0.078**	0.074**
	(0.031)	(0.031)	(0.031)	(0.031)
CEO internationalization × CEO fixed comp.	0.124	0.186	0.260	0.193
	(0.121)	(0.150)	(0.160)	(0.126)
CEO internationalization × CEO variable comp.	-0.182**	-0.184**	-0.191***	-0.185**
	(0.070)	(0.070)	(0.071)	(0.072)
TMT gender diversity	0.382**	0.469**	0.471**	0.383**
	(0.180)	(0.193)	(0.209)	(0.177)
TMT age diversity	-0.396	-0.558*	-0.220	-0.546*
	(0.358)	(0.301)	(0.360)	(0.309)
TMT tenure diversity	0.293***	0.307***	0.170**	0.149**
	(0.107)	(0.107)	(0.073)	(0.067)
CEO internationalization × TMT gender diversity		-0.470	-0.628	
		(0.438)	(0.472)	
CEO internationalization × TMT age diversity	-0.414		-1.674	
	(1.406)		(1.337)	
CEO internationalization × TMT tenure diversity	-0.485**	-0.493***		
	(0.200)	(0.169)		
CEO age	0.005	0.005	0.005	0.005
	(0.004)	(0.004)	(0.004)	(0.004)
CEO tenure	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.003)	(0.003)
CEO education	0.058*	0.059*	0.059*	0.057*
	(0.030)	(0.031)	(0.031)	(0.030)
TMT size	-0.028	-0.028	-0.027	-0.028
	(0.018)	(0.017)	(0.018)	(0.019)
Sales	0.030***	0.030***	0.030***	0.030***
	(0.010)	(0.010)	(0.010)	(0.010)
Employees	0.003	0.003	0.003	0.003
	(0.004)	(0.004)	(0.004)	(0.004)
ROA	0.005**	0.005**	0.004*	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-1.551***	-1.603***	-1.524***	-1.437***
	(0.261)	(0.282)	(0.262)	(0.244)
Observations	248	248	248	248
R^2 within	0.630	0.632	0.625	0.620
R^2 between	0.904	0.906	0.906	0.905
R^2 overall	0.903	0.905	0.904	0.904
F	39.02***	31.87***	28.93***	40.75***

Notes: *** p < 0.01, ** p < 0.05, * p < 0.10; robust standard errors in parentheses

Overall, our results remain relatively similar to those from the base specification. It should be noted though that the effect of *CEO internationalization* becomes insignificant in Models 6 and 10, in which entire moderator groups are excluded. Similarly, the levels of significance of some direct coefficients change. Most notably, the direct effect of *CEO variable compensation* becomes insignificant (Models 5 and 6) and *TMT age diversity* significantly negative (Models 8 and 10), when the corresponding interaction term is removed. These are clear signs that the effects of the direct coefficients and moderating terms tend to be conditional. In other words, when the interaction terms are removed, the effect of the excluded interaction terms are partly absorbed by the corresponding direct variables, resulting in biased coefficients[26]. By including the moderator variables in our models, we thus forego potential concerns regarding omitted variable bias.

[26] Interestingly, the bias caused by the removal of the *CEO variable compensation* interaction with *CEO internationalization* seems to be fairly persistent; that is, compared to the base Model 1, in Model 0, which includes the control variables only, the same variables are subject to changed levels of significance as those in Models 5 and 6.

Table 11: Robustness checks (Part II)

	Strategic risk-taking$_{t+1}$		
VARIABLES	**(1) Base**	**(11) Time trend**	**(12) Time FEs**
CEO internationalization	0.577***	0.569***	0.476**
	(0.203)	(0.212)	(0.218)
CEO fixed compensation	-0.076	-0.084	-0.091
	(0.063)	(0.067)	(0.061)
CEO variable compensation	0.076**	0.075**	0.074**
	(0.031)	(0.031)	(0.030)
CEO internationalization	0.191	0.188	0.226
× CEO fixed comp.	(0.153)	(0.154)	(0.166)
CEO internationalization	-0.186**	-0.187**	-0.181***
× CEO variable comp.	(0.070)	(0.070)	(0.068)
TMT gender diversity	0.467**	0.455**	0.428**
	(0.199)	(0.202)	(0.209)
TMT age diversity	-0.404	-0.379	-0.435
	(0.378)	(0.385)	(0.389)
TMT tenure diversity	0.299***	0.295**	0.275**
	(0.111)	(0.115)	(0.112)
CEO internationalization	-0.509	-0.489	-0.451
× TMT gender diversity	(0.435)	(0.436)	(0.464)
CEO internationalization	-0.666	-0.617	-0.501
× TMT age diversity	(1.391)	(1.386)	(1.340)
CEO internationalization	-0.457**	-0.448**	-0.439**
× TMT tenure diversity	(0.189)	(0.196)	(0.181)
CEO age	0.005	0.004	0.004
	(0.004)	(0.004)	(0.004)
CEO tenure	0.007***	0.007***	0.006**
	(0.002)	(0.002)	(0.002)
CEO education	0.059*	0.062**	0.060**
	(0.031)	(0.029)	(0.029)
TMT size	-0.028	-0.026	-0.023
	(0.017)	(0.018)	(0.018)
Sales	0.030***	0.030***	0.031***
	(0.010)	(0.010)	(0.010)
Employees	0.003	0.003	0.003
	(0.004)	(0.004)	(0.004)
ROA	0.005**	0.005**	0.006**
	(0.002)	(0.002)	(0.002)
Time trend		0.005	
		(0.008)	
Constant	-1.605***	-12.420	-1.515***
	(0.281)	(16.100)	(0.313)
Additional time fixed effects	No	No	Yes
Observations	248	248	248
R^2 within	0.632	0.633	0.644
R^2 between	0.906	0.905	0.904
R^2 overall	0.905	0.904	0.902
F	29.00***	26.75***	30.22***

Notes: *** p < 0.01, ** p < 0.05, * p < 0.10; robust standard errors in parentheses

Table 11: Robustness checks (Part II) (continued)

	Strategic risk-taking$_{t+1}$	*Strategic risk-taking*$_{t+2}$	*Strategic risk-taking*$_{MovAv}$
VARIABLES	**(1) Base**	**(13) Base**	**(14) Base**
CEO internationalization	0.577***	0.210	0.389**
	(0.203)	(0.150)	(0.153)
CEO fixed compensation	-0.076	-0.133	-0.105
	(0.063)	(0.090)	(0.072)
CEO variable compensation	0.076**	0.046***	0.060***
	(0.031)	(0.015)	(0.019)
CEO internationalization	0.191	0.220	0.205
× CEO fixed comp.	(0.153)	(0.138)	(0.133)
CEO internationalization	-0.186**	-0.091**	-0.137***
× CEO variable comp.	(0.070)	(0.039)	(0.043)
TMT gender diversity	0.467**	0.399***	0.432**
	(0.199)	(0.148)	(0.166)
TMT age diversity	-0.404	-0.087	-0.242
	(0.378)	(0.361)	(0.353)
TMT tenure diversity	0.299***	0.168**	0.232**
	(0.111)	(0.081)	(0.094)
CEO internationalization	-0.509	-0.555	-0.529
× TMT gender diversity	(0.435)	(0.508)	(0.436)
CEO internationalization	-0.666	-0.747	-0.701
× TMT age diversity	(1.391)	(1.037)	(1.068)
CEO internationalization	-0.457**	-0.269*	-0.361**
× TMT tenure diversity	(0.189)	(0.137)	(0.155)
CEO age	0.005	0.006*	0.006*
	(0.004)	(0.003)	(0.003)
CEO tenure	0.007***	0.005***	0.006***
	(0.002)	(0.002)	(0.002)
CEO education	0.059*	0.024	0.041*
	(0.031)	(0.021)	(0.024)
TMT size	-0.028	-0.022	-0.025
	(0.017)	(0.017)	(0.016)
Sales	0.030***	0.040***	0.035***
	(0.010)	(0.010)	(0.010)
Employees	0.003	-0.003	0.000
	(0.004)	(0.004)	(0.003)
ROA	0.005**	0.001	0.003
	(0.002)	(0.002)	(0.002)
Time trend			
Constant	-1.605***	-1.119***	-1.360***
	(0.281)	(0.218)	(0.225)
Additional time fixed effects	No	No	No
Observations	248	248	248
R^2 within	0.632	0.692	0.711
R^2 between	0.906	0.806	0.871
R^2 overall	0.905	0.802	0.870
F	29.00***	6.14***	17.20***

Notes: *** p < 0.01, ** p < 0.05, * p < 0.10; robust standard errors in parentheses

Second, as shown in Table 11, we add time-specific effects to our models to capture further unobserved time-varying heterogeneity in the data. Model 11 includes a time trend variable, which is not significant. In Model 12, a two-way fixed effects model is analyzed by using the Huber-White Sandwich estimator with additional year fixed effects. For both models, the main coefficients remain mostly unchanged.

Third, we modify the time dimension of the strategic risk-taking variable (see Table 11), moving it further toward the future. In this way, we account for the possibility that the association between *CEO internationalization* and *strategic risk-taking* may only come into effect with a certain time delay. For instance, the implementation of new long-term R&D projects may not happen instantaneously, delaying the corresponding expenditures of firms. Moreover, this change in the regressand further reduces possible endogeneity concerns. In Model 13, we measure *strategic risk-taking* at year t+2. In Model 14, we take the moving average of the years t+1 and t+2. While the association between *CEO internationalization* and *strategic risk-taking* measured at t+2 becomes insignificant, the coefficient of the moving average variable is significant but smaller compared to that of the base specification in Model 1. An explanation for this finding is that the impact of top managers' choices gradually diminishes as time progresses.

Table 12: Robustness checks (Part III)

	Strategic risk taking$_{t+1}$			
	(1)	**(15)**	**(16)**	**(17)**
VARIABLES	**Base**	**CEO functional background**	**TMT cultural background**	**Firm controls**
CEO internationalization	0.577***	0.605***	0.529***	0.572***
	(0.203)	(0.197)	(0.180)	(0.201)
CEO fixed compensation	-0.076	-0.069	-0.071	-0.075
	(0.063)	(0.061)	(0.061)	(0.066)
CEO variable compensation	0.076**	0.073**	0.076**	0.075**
	(0.031)	(0.031)	(0.031)	(0.033)
CEO internationalization	0.191	0.160	0.201	0.188
× CEO fixed compensation	(0.153)	(0.150)	(0.150)	(0.160)
CEO internationalization	-0.186**	-0.177**	-0.187**	-0.188**
× CEO variable compens.	(0.070)	(0.069)	(0.072)	(0.073)
TMT gender diversity	0.467**	0.455**	0.488**	0.444**
	(0.199)	(0.199)	(0.207)	(0.209)
TMT age diversity	-0.404	-0.369	-0.470	-0.442
	(0.378)	(0.372)	(0.385)	(0.381)
TMT tenure diversity	0.299***	0.294**	0.303***	0.299***
	(0.111)	(0.116)	(0.109)	(0.107)
CEO internationalization	-0.509	-0.544	-0.521	-0.517
× TMT gender diversity	(0.435)	(0.402)	(0.435)	(0.426)
CEO internationalization	-0.666	-0.711	-0.476	-0.547
× TMT age diversity	(1.391)	(1.366)	(1.311)	(1.389)
CEO internationalization	-0.457**	-0.443**	-0.428**	-0.443**
× TMT tenure diversity	(0.189)	(0.194)	(0.185)	(0.184)
CEO age	0.005	0.004	0.005	0.005
	(0.004)	(0.004)	(0.004)	(0.004)
CEO tenure	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
CEO education	0.059*	0.074**	0.063*	0.056*
	(0.031)	(0.036)	(0.032)	(0.031)
TMT size	-0.028	-0.020	-0.028*	-0.026
	(0.017)	(0.016)	(0.016)	(0.017)
Sales	0.030***	0.030***	0.030***	0.030***
	(0.010)	(0.010)	(0.010)	(0.010)
Employees	0.003	0.004	0.003	0.004
	(0.004)	(0.004)	(0.004)	(0.004)
ROA	0.005**	0.005**	0.006**	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)

Table 12: Robustness checks (Part III) (continued)

	Strategic risk taking$_{t+1}$			
	(1)	**(15)**	**(16)**	**(17)**
VARIABLES	**Base**	**CEO functional background**	**TMT cultural background**	**Firm controls**
⋮				
CEO output and peripheral background		0.127		
		(0.094)		
CEO general management background		0.061		
		(0.054)		
TMT foreignness			-0.005	
			(0.243)	
TMT Hofstede			-0.007	
			(0.006)	
TMT GLOBE			0.003	
			(0.272)	
Net income				0.007
				(0.007)
Foreign sales to total sales (FSTS)				-0.001
				(0.001)
Quick ratio				-0.005
				(0.009)
Constant	-1.605***	-1.697***	-1.136	-1.557***
	(0.281)	(0.307)	(1.415)	(0.313)
Observations	248	248	248	248
***R²* within**	0.632	0.636	0.635	0.635
***R²* between**	0.906	0.901	0.905	0.908
***R²* overall**	0.905	0.901	0.904	0.907
F	29.00***	32.50***	36.07***	51.42***

Notes: *** p < 0.01, ** p < 0.05, * p < 0.10; robust standard errors in parentheses

Fourth, we added several additional variables, which were associated with firm risk in prior studies (see Table 12). In particular, we account for the CEO's functional background in Model 15. In Model 16, we add several variables that reflect the cultural background of the TMT (i.e., foreignness, Hofstede index, and GLOBE index). Finally, additional firm-level controls are included in Model 17 (i.e., net income, foreign sales, and quick ratio). None of the newly added control variables was significant or fundamentally altered our results.

Overall, the additional estimations underline the robustness of our model, as the results obtained are fairly similar to those of the base specification. Furthermore, we receive statistical support for our reasoning of focusing on a model that includes all interaction terms.

3.4.3 Additional analyses

Strategic decisions in firms are rarely made by only the CEO. Consequently, Hambrick and Mason (1984) suggested the investigation of entire TMTs and inspired a vast amount of subsequent team-level research. More recent studies highlight again the dissimilar levels of power and status among TMT members (S. Nielsen, 2010a), and for firm decision-making, these studies encourage the study of entities other than the CEO (Cannella & Holcomb, 2005; Cao et al., 2010), such as the role of the CFO. To obtain an even more refined understanding about the role that the internationalization of upper echelons plays for strategic risk-taking, we thus estimate two additional models with 1) indicators for the other TMT members' internationalization (*Rest TMT internationalization*) (Model 2) and 2) the internationalization profile of the CFO (*CFO internationalization*) (Model 3) included as control variables. The models build upon the robust base specification and, apart from their internationalization effects, also include the corresponding compensation indicators (i.e., *Rest TMT / CFO fixed compensation, Rest TMT / CFO variable compensation*). While the CFO variables are calculated in a manner analogous to that used for the CEO variables, the TMT variables are computed by taking the group-level average of each TMT members' internationalization and compensation scores except those for the CEO. The results are shown in Table 9.

We do not find any significant effects for the added variables, which suggests that neither the internationalization and compensation of the remaining TMT members nor that of the CFO is associated with significant changes in *strategic risk-taking*. Instead, the significant effects from the base specification remain unchanged, emphasizing the particular role of CEO internationalization for strategic risk-taking. In this way, our results support the notion that power differentials exist within TMTs, with the CEO assuming extraordinary power with respect to the decision-making in firms (Finkelstein, 1992).

3.5 Discussion and conclusion

Risk-taking is considered an essential component of a CEO's job. Because risk is subjective and the related responses depend on the individual's assessment of the situation (Kahneman & Tversky, 1982), important behavioral implications arise for firms. Building on prior studies

that highlight the decisive impact of international experiences for top managers' cognition and decision-making, our research examines whether and to what extent the internationalization of CEOs is associated with a firms' strategic risk-taking. Combining upper echelons theory with insights from the psychology and corporate governance literatures, we argue that international CEOs engage in greater risk-taking because of their partially acquired higher levels of self-confidence and openness for ambiguity, as well as their possession of a supporting network. In this way, we add relevant insights to the questions of what drives managerial risk-taking in firms and what influence CEO internationalization has on firm-level outcomes.

Our research results show that MNEs led by internationally seasoned CEOs are indeed more inclined to commit to corporate strategies involving higher levels of risk than those led by internationally inexperienced CEOs. In the upper echelons field, this finding aligns with previous studies that found supporting evidence for a positive influence of CEOs' international experience on firms' international involvement, which is commonly associated with greater uncertainty and risk (e.g., Daily et al., 2000; Herrmann & Datta, 2006). By focusing on strategic risk-taking as a firm-level outcome, we extend this line of research and provide empirical evidence that CEO internationalization also has a significant impact at a more general level. Accordingly, we add relevant insights to recent calls of researchers for a deeper inquiry of the association between top management internationalization and strategic choices (S. Nielsen, 2010b; Oxelheim et al., 2013).

Our results are also relevant for the IB literature, which emphasizes the benefit to MNEs in having internationally seasoned executives, as they are better able to navigate the firm through the complexity of global business (Athanassiou & Nigh, 2000; P. Greve et al., 2015). In the attempt of matching top managers with the firms' global task demands, MNEs have tried to fill the TMT with individuals who possess international experience (Greve et al., 2009; Kunisch et al., 2019). Although international CEOs seemingly offer benefits for firms on an international level, the results of our study suggest that possible downsides may be perceived at the overall firm-level. Specifically, the greater risk-taking propensity associated with international CEOs may be beneficial for firms up to a certain point, but negative consequences may arise if strategies entailing inappropriate levels of risk are pursued. In such cases, the advantages for firms' international operations brought about by international CEOs might be offset by adverse effects at the broader firm-level. Consequently, MNEs should be sensitized regarding possible risks that the appointment of international CEOs may entail. By pointing to the potential downsides, we complement recent IB research that adopts a more

critical view on the implications of board internationalization (e.g., Hooghiemstra et al., 2019; Masulis et al., 2012).

With our study, we also advance research that emphasizes the importance of accounting for contextual factors when investigating the firm-level consequences of top managers' background characteristics (Carpenter et al., 2004). Building on our expectation that the internationalization of CEOs enhances firms' strategic risk-taking, we were particularly interested in obtaining a refined understanding of the governance mechanisms that have the potential of channeling executives' individual risk preferences and behaviors. In this way, we contribute relevant insights to the corporate governance literature.

First, we add to the inconclusive discussion related to the executive compensation-performance link (e.g., Schmid & Wurster, 2016). More specifically, a vast body of research has sought to explore the implications of different incentives and compensation structures (e.g., fixed vs. variable pay) for managerial decision-making (Hoskisson et al., 2016; O'Connell et al., 2018). Against our predictions of finding a positive effect, our results show a significant negative moderating effect of CEO variable compensation. A possible explanation for this finding may lie in the measurement of our variable compensation indicator, which encompasses both equity compensation and bonuses. Recent research has purported that the inconclusive findings regarding the implications of executive compensation might be caused by the aggregate analysis of compensation elements with diverging characteristics (Devers et al., 2008). Indeed behavioral scholars claim that CEOs perceive and respond differently to different kinds of compensation elements (Devers et al., 2008; O'Connell et al., 2018; Sanders, 2001). By splitting the variable compensation measure into its separate elements, a more exact picture about international CEOs risk-taking behavior may be drawn.

Second, we propose that TMT diversity is an effective governance mechanism in the context of managerial decision-making. Hence, we go beyond the classical compensation instruments commonly discussed in agency theory and suggest that more implicit structural means may significantly impact managerial risk-taking as well. In this way, we counter past criticism of scholars who claim that the classical agency approach disregards the social context, which actually has important effects on top managers' cognition and behavior (Fernández-Pérez et al., 2016; Lubatkin et al., 2007).

By paying attention to TMT diversity, we also expand research on the heterogeneity in upper echelons. While prior research mainly focused on the direct effects of TMT diversity (S. Nielsen, 2010a), our work sheds light on the implications of TMT diversity as an interaction variable. Our results reveal that TMT tenure diversity represents a significant boundary condition in the context of CEO internationalization and strategic risk-taking. Given its soothing influence on risk-taking, TMT tenure diversity may act as a means to decrease the possibility of excessive risk-taking behaviors of CEOs. Contrary to our expectation, we did not find evidence for moderating effects of gender diversity and age diversity. A possible explanation is our sample size, which might limit the ability of the variation in our variables to explain underlying relationships[27]. Moreover, the topic of TMT diversity is highly controversial (S. Nielsen, 2010a), and prior studies found mixed effects for both variables (e.g., Sila et al., 2016; Tihanyi et al., 2000). Few scholars presume that demographic variables in general and the focus on symmetric effects when testing diversity variables may be too simple to explain underlying implications (e.g., Aggarwal et al., 2019; Díaz-Fernández et al., 2020). This notion aligns with a study by Driesch et al. (2015), whose findings underline the ambivalent and complex effects underlying age and tenure variables in upper echelons research.

Finally, by examining the TMT as a possible influencing factor of CEO decision-making, we also contribute to the growing body of research on the CEO-TMT interface. Specifically, we respond to Hoskisson et al.'s (2016) call for further research on the interplay between the CEO and the other TMT members in the context of risk-taking. Knowledge about the effect of TMT diversity may also be particularly relevant for supervisory boards and other control functions responsible for the design of appropriate compensation packages and the appointment of a well-balanced management team.

3.6 Limitations and future research

As applicable to all studies, our research is subject to several limitations, which open up opportunities for further research. Despite all control variables and measures that we include in our models, we cannot disengage ourselves from the possibility that the observed differences in strategic risk-taking are caused by the CEOs' internationalization, nor can we be certain that unobservable factors at the top management- and firm-levels systematically affect

[27] The proportion of women present in the entire sample is relatively low (i.e., 4.6%), with an average proportion of women in TMTs of 3.5% (i.e., across all firm-years). Regarding age, there is an age spread of 41 years across the sample: the youngest TMT member is 31, and the oldest is 72.

the risk-taking behavior of firms. Qualitative studies might complement our quantitative analysis and try to explore the relationship between international CEOs and strategic risk-taking in more detail (e.g., through observations). However, the limited availability of top managers for personal investigations might pose critical challenges (e.g., Hambrick, 2007).

Similarly, future research could pay even more attention to relevant boundary conditions. Although we tried to account for two important contextual factors (i.e., CEO compensation and TMT diversity), many other internal and external aspects might influence the international CEOs' perception of risk and subsequent behavior at various levels. For instance, future research could examine the role of intrinsic factors, such as personal values or emotional traits (Hoskisson et al., 2016). A relevant external aspect that might affect the international CEOs' risk-taking behavior is the presence of a directors and officers (D&O) insurance, which has become a common component of firms' risk management and which is particularly relevant for firms with international offices and subsidiaries (Allianz, 2019).

Finally, we aim to cover risk-taking from a more holistic firm-level perspective and rely on an index that is applied in various studies (e.g., Devers et al., 2008; Kish-Gephart & Tochman Campbell, 2015). The index mainly defines risk-taking from a temporal perspective, thereby considering long-term investments as riskier than short-term investments. Even if the outcomes of short-term investments and other actions become apparent in less time, they are still likely to carry certain risks with possible negative consequences for firms. To obtain a more refined understanding of managerial risk-taking, future research could use alternative outcome measures of risk-taking in firms and consider both short- and long-term perspectives.

CHAPTER 4

Research article 3

Top managers in the digital age: Exploring the role and practices of top managers in firms' digital transformation

Abstract

This study explores the role and facilitating actions of top managers in response to the digital transformation. Building on 27 in-depth interviews with top managers and close associates from large German firms, we find that top managers respond to the digital transformation by engaging in three key actions: understanding digitalization, setting the formal context for digitalization, and leading change. Moreover, findings emphasize that top management team support is essential in firms' digital transformation. Overall, this study contributes novel insights about the consequences of top managers for firms and establishes an initial foundation for investigating top managers in the digital age.

Keywords

Top managers, digital transformation, digital strategy, leadership, change management

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"In times of change, the greatest danger is to act with yesterday's logic."

Peter Drucker (1909-2005)

4.1 Introduction

The digital revolution is currently transforming entire industries and the overall competitive landscape. Established business models are challenged by changing customer expectations and behaviors, as well as new and rapidly growing market entrants with disruptive digital business ideas (Verhoef et al., 2019). A representative example for these changing market dynamics includes, for instance, digital streaming services, which re-defined customers' way of listening to music and watching movies (e.g., Spotify or Netflix). Another example are sharing ventures, which grant access to products and services without requiring formal ownership (e.g., Uber or Airbnb). Significant challenges are also observable inside of firms, as digital technologies change the way products are produced and the way employees work and collaborate (Schwarzmüller, Brosi, Duman, & Welpe, 2018). In order to keep up with the development and remain successful, firms need to adjust and respond to these changing realities. The term 'digital transformation', which Verhoef et al. (2019) define as "a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm" (p.1), reflects and emphasizes the implications at the firm-level[28]. For top managers, who are considered as firms' key decision-makers (Finkelstein & Hambrick, 1996; Hambrick & Mason, 1984), the digital transformation means an altered decision-making context and unprecedented challenges. In fact, given the novelty of the digital transformation, top managers cannot rely on proven approaches, requiring them to assess the firm's situation comprehensively in order to develop tailored responses.

Despite the decisive role of top managers for strategic decision-making in firms and the growing awareness regarding the digital transformation in practice, our empirical understanding of top managers' role therein is very limited. The role of top managers in corporate environments has mainly been discussed within upper echelons theory (Hambrick & Mason, 1984) or strategic leadership research (Finkelstein, Hambrick, & Cannella, 2009). Even though a large volume of studies has contributed toward a comprehensive understanding of top managers' role in and influence on firms, only very few studies in this research area

[28] We acknowledge that various terms exist that aim to capture the impact that digital resources have on firms. Specifically, differences exist concerning the terms 'digitization,' 'digitalization,' and 'digital transformation,' because each describe a different phase of digital transformation (Verhoef et al., 2019). In this study, we do not explicitly differentiate between the different terms' meanings but use them interchangeably for any influences of digital aspects on firms. In this way, we also match the German language and business context, in which the use of such a fine-grained definition has been largely neglected (Staudt, 2019).

addressed digital aspects. Nevertheless, extant studies provide initial indications pointing toward the leading position that top managers assume in firms' digital transformation processes. In fact, prior research found significant relationships between top managers and firms' commitment to the status quo (Hambrick, Geletkanycz, & Fredrickson, 1993) and corporate strategic change (Wiersema & Bantel, 1992). Besides, scholars suggest that top managers play a crucial role in firms' innovation efforts (Damanpour, 1991; Smith & Tushman, 2005; Wrede & Dauth, 2020). We assume that all these aspects represent critical elements in the digital transformation, too. Given the growing prevalence of digitalization in the public debate as well as the growing pressure for firms to adjust to changing market conditions, it is essential to generate a theoretical understanding of the role and practices of the top management team (TMT) in the digital transformation. With this study, we aim to contribute relevant empirical insights by investigating the question '*How do top managers respond to and facilitate the firm's digital transformation?*'

The study draws on 27 in-depth interviews with representatives from large stock-listed German firms that can provide informed answers about the behaviors and decision-making at the top of the corporate hierarchy. To answer the research question, we specifically focus on top managers' roles and concrete actions in response to the changes brought about by the digital transformation. Our interview partners are top managers themselves and individuals that are in a close position to top managers in their respective firms. By relying on a sample of large, stock-listed German firms, we investigate a particularly interesting research setting for our study. More specifically, the core characteristics of our sample firms (i.e., large and stock-listed) imply that all firms are incumbents – a type of firm for whom "the digital transformation is particularly relevant" (Verhoef et al., 2019, p.4). Because incumbent firms build on established structures and processes, they often need to make decisions involving a trade-off between new and existing business practices (C. M. Christensen, Bartman, & van Bever, 2016; Markides, 2006). The decisions made by top managers thus play a significant role in defining a firm's digital transformation path.

The main contribution of this study is an emerging theoretical framework for the role and facilitating actions of top managers in firms' digital transformation. Our analysis reveals that top managers rely on three distinct sets of action: understanding digitalization, setting the formal context for digitalization, and leading change. Overall, our findings emphasize the significant role that top managers assume in firms' digital transformation processes, in that their commitment and support at the top is needed to enable change processes and targeted actions throughout the entire organization. By delineating the specific role and actions of top

managers in the context of firms' digital transformation processes, this study provides novel insights about the consequences of top managers for firms. More generally, it establishes an initial foundation for the further investigation of top managers in the digital age.

4.2 Theoretical background

4.2.1 Digitalization – Transforming the way business is done

With the emergence of digital technologies (e.g., the Internet, smartphones, crypto currencies, etc.) began the revolution of established business models and of the way in which business is done. Ever since the nature and scope of competition, as well as the behavior of customers has fundamentally changed (Verhoef et al., 2019). For instance, competition has become increasingly international, and relatively young digital firms challenge the long-time successful business models of incumbents. In 2004, the most valuable firms on the S&P 500 index were General Electric, Exxon Mobil, Microsoft, Citigroup, and Walmart (ETF Database, 2004) – only one of which represents a truly digital firm. Fifteen years later, the index components have changed significantly, with five digital and information-rich firms, i.e. Apple, Microsoft, Alphabet, Amazon, and Facebook, taking the lead (Siblis Research, 2019). Digital influences are also perceivable in terms of consumer behavior. In particular, consumers increasingly shift their purchases to online channels, as reflected in the growing volume of global e-commerce sales. While the proportion of e-commerce to total global retail sales marked 14.1% in 2019, it is projected to grow to 22% in 2023 (Statista, 2019). Among others, changes in consumer behaviors and experiences are facilitated by the rising number of digital touchpoints, such as the increasing reliance on social media, apps, new AI-supported technologies, and smart devices like Apple's Siri, Google Home or Amazon's Alexa (e.g., Hoffman & Novak, 2018; Lemon & Verhoef, 2016). Additionally, mobile phones are popularly used to compare offline and online offers (Gensler, Neslin, & Verhoef, 2017). In response to this significantly changing context, firms striving to maintain or enhance their competitive position need to make fundamental adjustments throughout the organization.

Despite the tremendous impact of the digital transformation on firms and its broad coverage in the media, "the academic literature has so far paid surprisingly little attention to these [digital] developments" (Verhoef et al., 2019, p.1) though. Reasons for this lack of research include, for instance, that the digital transformation is a relatively recent phenomenon, and the rapid technological advancement impedes the timely and broad investigation of contemporary phenomena (Schwarzmüller et al., 2018). Additionally, in line with the multidimensional nature of the digital transformation, the extant literature is highly fragmented, which limits our ability to understand the consequences of this complex

development comprehensively and to detect larger change patterns (Hausberg, Liere-Netheler, Packmohr, Pakura, & Vogelsang, 2019; Schwarzmüller et al., 2018; Verhoef et al., 2019).

On a broad level, prior literature suggests that the digital transformation progresses in phases. It begins with the simple conversion of information from an analog into a digital format (i.e., *digitization*) (Loebbecke & Picot, 2015), evolves into the use of digital technologies to change existing business processes (i.e., *digitalization*) (Li, Nucciarelli, Roden, & Graham, 2016), and finally mounts in the adoption of a new business logic for value creation (i.e., *digital transformation*) (Pagani & Pardo, 2017). Since the digital transformation affects firms in their entirety, changes and adjustments will be observable at different levels of the organization (Hausberg et al., 2019). Consistent with this notion, prior research on digitalization aspects was mostly carried out within specific business disciplines (Nambisan, Wright, & Feldman, 2019). In their systematic literature review and citation network analysis, Hausberg et al. (2019) suggest that the extant literature on digital transformation is dominated by three specific research streams: finance, marketing, and innovation management. The specific research foci range from the implications of big data and analytics for trading and market prediction (finance), to social media effects, digital advertising, and customer relationship management (marketing), to business model innovation as well as the adoption and diffusion of innovations (innovation management). Research on digital transformation notably lacks in the fields of accounting, sustainability, and human resource management (Hausberg et al., 2019).

An aspect that has been widely neglected throughout the academic discourse is the role and actions of top managers in response to the digital transformation. Prior studies claim that top management support is vital for the digital transformation to unfold, as it is the executive team that shapes the necessary context and provides resources (Cortellazzo, Bruni, & Zampieri, 2019; de la Boutetière, Montagner, & Reich, 2018; Matt, Hess, & Benlian, 2015). Although various studies across different academic disciplines and specifically within the practitioners' literature underline the relevance of top managers in firms' digital transformation processes, a comprehensive understanding is still absent. Following the call of Verhoef et al. (2019) for a more in-depth investigation of board compositions as an influencer of digitalization and related firm performance, this study aims to contribute relevant insights. By analyzing top managers' involvement in the digital transformation, we not only address a significant gap in the academic literature but also offer valuable knowledge to practitioners, top managers, and organizations that are navigating through the seemingly uncertain spheres of the digital transformation.

4.2.2 Top managers – the shapers of firm strategy

The influential role of top managers in firms has been a key concern in strategic management research. In particular, research building on the upper echelons theory (Hambrick & Mason, 1984) has produced a large body of knowledge on the antecedents and firm-specific consequences of top managers. Relevant studies specifically focused on top managers' characteristics (e.g., demographic characteristics, personality traits or values) to proxy for underlying cognitive bases (Carpenter, Geletkanycz, & Sanders, 2004; Hambrick, 2007). The strategic leadership literature presents another important theoretical perspective on top managers in firms. Studies within this field concentrate in particular on the different functions carried out by leaders that are intended to have strategic implications for firms (Finkelstein et al., 2009; Samimi, Cortes, Anderson, & Herrmann, 2020). The foundational assumption underlying both research streams is that "top executives matter" (Hambrick & Mason, 1984, p.194) for a wide range of firm-level outcomes. More specifically, scholars found that through their decision-making power and leadership they provide to the firm, top managers have a significant influence on firm strategies and performance (e.g., Certo, Dalton, Dalton, & Lester, 2006; Finkelstein et al., 2009; Finkelstein & Hambrick, 1996; Hambrick, 2007). The ability of, or more precisely, the extent to which top managers exert influence on firm-level outcomes has formally been captured by the concept 'managerial discretion' (Wangrow, Schepker, & Barker, 2015). According to several researchers, top managers' discretion, and especially that of CEOs, has significantly increased in recent years (Quigley & Hambrick, 2015), emphasizing the need to explore the consequences of top managers' choices and behavior in more detail. In present times, top managers are particularly challenged to ensure the competitiveness of their firm by formulating and executing a business strategy that considers the opportunities and risks of the digital transformation (Hess, Matt, Benlian, & Wiesböck, 2016).

When taking a closer look at the academic literature, however, it becomes evident that studies investigating the antecedents and consequences of top managers' characteristics and behaviors have considered digitalization aspects only rarely. An overview of relevant studies is provided in Table 13. Existing empirical studies directly associating top managers with digitalization aspects investigated, for instance, dedicated digitalization-specific roles within the executive team (Horlacher & Hess, 2016; Medcof, 2008; Singh & Hess, 2017) or the nature of leadership (Cortellazzo et al., 2019; Schwarzmüller et al., 2018). In general, these studies jointly highlight the vast and multifaceted impact that the digital transformation has on firms as well as its top managers. Additionally, they demonstrate the need for further research into this far-reaching and increasingly relevant topic.

Table 13: Existing studies associating top managers with the digital transformation

DIRECT associations

Study	Title	Main focus	Key insights on the association between top managers and digital transformation
Singh & Hess (2017)	How chief digital officers promote the digital transformation of their companies	Functional roles (CDO)	• Chief Digital Officers (CDOs) are increasingly included in top management teams of firms that go through a digital transformation • Main drivers for the employment of CDOs: 1) market pressures for firms to digitally transform; 2) high internal complexity in coordinating transformation efforts throughout the firm • Three role types CDOs mainly play: Entrepreneur, digital evangelist, coordinator • Key skills and competencies: IT competency, change management skills, inspiration skills, digital pioneering skills, resilience
Medcof (2008)	The organizational influence of the chief technology officer	Functional roles (CTO)	• Chief Technology Officers (CTOs) striving for influence in their firms should build their power bases on a deep understanding of the firm, its business and overall context, social network internal and external of the firm, as well as ownership position in the firm • The influence of the CTO is moderated by the CEOs leadership style
Horlacher & Hess (2016)	What does a chief digital officer do? Managerial tasks and roles of a new C-level position in the context of digital transformation	Functional roles (CDO)	• CDOs act as catalysts for change in their firms • Main responsibilities: strategy (i.e., develop and execute digitalization strategies) and communication (i.e., act as spokesperson and leader to oppose cultural resistance • In case of co-existence, CDOs and CIOs work closely together

Table 13: Existing studies associating top managers with the digital transformation (continued)

Schwarzmüller et al. (2018)	How does the digital transformation affect organizations? Key themes of change in work design and leadership	Nature of leadership	• Competency requirements for leaders in the digital transformation: intercultural and language competencies; leading from a distance (i.e., globally dispersed and virtual teams); effectively managing uncertainty, complexity and change; IT competencies and life-long learning • Leaders are expected to lead in a more participatory way (i.e., grant more autonomy to followers, trust employees, inspire and motivate followers) • There is an increased importance of relationship-oriented leadership (i.e., promoting employee behavior through coaching and enabling behavior, consider employees individual needs and lead accordingly, broaden network, teambuilding)
Cortellazzo et al. (2019)	The role of leadership in a digitalized world: A review	Nature of leadership	• Leaders actively shape the development of a digital culture by building relationships with various and diverse stakeholders • Leaders need to facilitate collaborative efforts in complex environments while considering critical ethical aspects

INDIRECT associations

Study	**Title**	**Main focus**	**Key insights on the association between top managers and digital transformation**
López-Muñoz & Escribá-Esteve (2017	An upper echelons perspective on information technology business value	TMTs and IT	• The value of information technology (IT) outcomes increases when the firm' s top management team (TMT) is deeply involved in actions involving IT (i.e., TMT – IT imbrication) • TMT demographic traits, IT competence, and internal processes (e.g., participatory decision-making and strategic consensus) are suggested to influence the TMT – IT imbrication

Table 13: Existing studies associating top managers with the digital transformation (continued)

Wrede & Dauth (2020)	A temporal perspective on the relationship between top management team internationalization and firms' innovativeness	TMTs and innovation	• Firms with internationally experienced TMTs are associated with a higher level of innovativeness • The relationship between international TMTs and firm innovativeness is influenced by the CEO's age
Elenkov et al. (2005)	Strategic leadership and executive innovation influence: An international multi-cluster comparative study	Leadership behaviors and innovation	• Strategic leadership behaviors (e.g., vision development, inspirational motivation, individual consideration or management by exception) positively affect executive influence on product-market innovations as well as administrative innovations • This relationship is contingent on the level of TMT tenure diversity
Hambrick et al. (1993)	Top executive commitment to the status quo: Some tests of its determinants	Commitment to the status quo	• Top managers tenure in an industry positively influences their commitment to the status quo. This impact is even stronger than that of tenure in the organization. The better the performance of the firm, the less top managers intend to make changes to the firm's strategy and leadership profile
Garms & Engelen (2018)	Innovation and R&D in the upper echelons: The association between the CTO's power depth and breadth and the TMT's commitment to innovation	Functional roles (CTO)	• Firms add Chief Technology Officers (CTOs) in their TMTs to ensure the visibility of and appropriate funding of R&D- as well as innovation-related topics • Innovation commitment is higher if the CTO has greater structural power (i.e., autonomy, legitimate power) within the firm • Innovation commitment rises if the CTO is passionate about and fully focused on innovation and R&D-related topics; vast scientific expertise decreases innovation commitment
Christensen et al. (2016)	The hard truth about business model innovation	Business model innovation	• To prevent failure of business model innovation, top managers need to understand the common (and predictable) stages through which business models develop • Over time, business models become more resistant to change

Source: Own compilation based on the cited studies

Despite the scarcity of research, related research foci provide initial indications for top managers' role in the digital transformation, such as studies associating top managers with innovation outcomes or change processes. For example, innovation scholars found that TMTs directly influence innovation in firms by determining the firm's innovation strategy (Elenkov, Judge, & Wright, 2005; Talke, Salomo, & Kock, 2011; Talke, Salomo, & Rost, 2010) and resource commitment (Wrede & Dauth, 2020). Additionally, they recognize new business opportunities (Shepherd, Mcmullen, & Ocasio, 2016; Yukl, 2010). Furthermore, top managers have been associated with firms' commitment to the status quo (Hambrick et al., 1993), corporate strategic change (Wiersema & Bantel, 1992) as well as risk-taking (Wright, Kroll, Krug, & Pettus, 2007). Moreover, prior research suggests that top managers play a critical role in business model innovation (C. M. Christensen et al., 2016) and in leading organizational change processes (Oreg, Bartunek, Lee, & Do, 2018; Venus, Stam, & van Knippenberg, 2019). Finally, López-Muñoz and Escribá-Esteve (2017) highlight the relevance of TMT support and commitment for firms' value creation from information technologies. Since the digital transformation is grounded in concepts like change and innovation, these studies underline the relevance of the study's topic and provide initial reference points for a deeper investigation of top managers in firms' digital transformation processes.

4.3 Data and method

4.3.1 Research context

In order to explore the role of top managers in firms' digital transformation processes, we carried out an inductive research study that builds on the Gioia methodology (Gioia, Corley, & Hamilton, 2013). Theoretically, the study mainly draws on upper echelons research and insights from the strategic management and leadership literature. While digitalization topics have rarely been addressed in top management research overall, we are also not aware of any research study that has empirically explored the broader role and actions of top managers in the digital transformation yet. The few existing studies focus on leadership behaviors (e.g., Schwarzmüller et al., 2018) as well as functional roles within the TMT (e.g., Singh & Hess, 2017). Consequently, the pursuit of obtaining an empirical understanding of the role of top managers in firms' digital transformation, as well as their related actions that aim to deal with this change process, remains at its outset. An exploratory research design thus represents a reasonable approach to collect first insights and to develop a basic theoretical framework.

4.3.2 Sampling logic and data collection

Our empirical study relies on 27 in-depth interviews. In line with Carpenter et al. (2004), who state that top managers are often identified based on their title or position, 17 out of the 27 respondents were defined as top managers (i.e., individuals with job titles that include the designations "Chief" (Cxx), "head", "(senior) vice president", and "director"). The remaining ten respondents had very close proximity to top managers and were very familiar with the top managers' tasks and decisions (e.g., executive assistants or other immediate reports). The interviews were conducted during a period from September 2019 until December 2019, either in person or via phone calls. To identify the sample firms, we relied on purposive sampling (Patton, 2015), which ensured that our selection of firms includes those that may provide us with comprehensive insights about the digitalization-related actions and decisions of top managers in large German firms. In particular, we limited our sampling frame to stock-listed firms located in Germany with at least 500 employees and that have been existing for ten years or longer. By drawing on firms fitting this profile, we specifically target a group of firms that we expect to have made conscious efforts to address digitalization topics. The revolutionizing nature of digitalization changes the way of doing business for firms and entire industries (Verhoef et al., 2019) and promises gains in efficiency, innovation, and competitiveness (Parida, Sjödin, & Reim, 2019). Consequently, it is reasonable to expect that top managers of incumbent firms think of suitable strategies that address the firms' changing conditions in order to meet the expectations of shareholders.

Our resultant sample comprises firms from a broad range of industries: aviation (AVIA), automotive (AUTO), chemicals (CHEM), conglomerate (CONG), consumer electronics (ELEC), energy (ENER), fast-moving consumer goods (FMCG), insurance (INSUR), logistics (LOGI), mechanical engineering (ENGI), media (MEDIA), pharmaceuticals (PHAR), retail (RETAIL), software (SOFT) and telecommunications (TELE). Next to covering firms from diverse industries, the size of the firms in terms of the number of individuals employed worldwide also varied significantly from 800 up to 650.000 employees. By gathering valuable information from such an extensive and diverse set of organizations, we can obtain a broad understanding of the digital transformation in large German firms. To obtain meaningful and comprehensive insights about the role of top managers in the digital transformation as well as their digitalization-related actions, we purposively interviewed either top managers directly or subordinates that have close ties with the top managers and can report about their

responsibilities, decisions, and actions based on their personal observation and experiences[29]. By targeting these specific individuals, we ensure the knowledgeability of our informants and thereby enhance the richness and credibility of our findings (Eisenhardt & Graebner, 2007; Flick, 2018). In addition, by interviewing both direct (i.e., top managers themselves) and indirect (i.e., close subordinates) informants at a broad range of firms, we obtain responses that illuminate the focal phenomenon from diverse perspectives. In this way, we limit the possibility of biases that are associated with interview data, such as retrospective sensemaking (Eisenhardt & Graebner, 2007).

The interviews were conducted using a semi-structured interview guideline. The questions addressed to the interviewees particularly targeted the relevance of the digital transformation for the firm and themselves, the management team's role and behavior in the digital transformation as well as specific actions emanating from top managers that aim to foster the digital transformation. The interviews lasted 40 minutes on average. To enable an in-depth analysis of the data, we recorded and transcribed the interviews. The identities of the sample firms and interviewees in the data were disguised to ensure confidentiality. The data collection was completed as soon as we were confident that the collected verbal accounts describe the focal phenomenon with sufficient depth and magnitude (Flick, 2018). Table 14 provides an overview of the firms and related respondents included in our study sample.

[29] We limited our analysis to one interviewee per sample firm (i.e., either top manager or close associate) for two main reasons. First, by collecting data from a larger sample size of firms, information on top managers' roles in many heterogeneous settings can be obtained. Second, top managers are often not available for interviews. A requirement to interview *both* top managers and associates thus would have restricted the set of firms eligible for interviews. The chosen approach ensures the broad scope that is essential to develop an initial understanding of top managers in the digital age.

Table 14: Summary of firms and respondents in the data collection

Firm	Industry	Founded in year	# of employees	Interviewee position
AUTO-1	Automotive	Before 1950	10.000 - 50.000	VP Product Strategy
AUTO-2	Automotive	Before 1950	>100.000	Executive Assistant to the CIO
AUTO-3	Automotive	1976 - 2000	10.000 - 50.000	Head of Global Purchasing
AUTO-4	Automotive	Before 1950	10.000 - 50.000	Project Leader
AUTO-5	Automotive	1950 - 1975	1.000 - 10.000	CEO
AUTO-6	Automotive	Before 1950	>100.000	AI- & Service Management Strategist
AVIA-1	Aviation	1950 - 1975	>100.000	Senior Director
BANK-1	Banking	1976 - 2000	10.000 - 50.000	CDO
BANK-2	Banking	1976 - 2000	10.000 - 50.000	Director Brand & Marketing Communications
CHEM-1	Chemicals	Before 1950	>100.000	Director Digital Transformation
CHEM-2	Chemicals	After 2000	10.000 - 50.000	CDO
CONG-1	Conglomerate	Before 1950	>100.000	Global Head of People Analytics
ELEC-1	Consumer electronics	1976 - 2000	50.000 - 100.000	Head of the CEO Office
ENER-1	Energy	1976 - 2000	10.000 - 50.000	Director Corporate Transformation - Digital
ENGI-1	Mechanical engineering	Before 1950	1.000 - 10.000	Head of Innovation Management / Corporate Developm.
FMCG-1	Consumer goods	Before 1950	50.000 - 100.000	Director R&D Management & Digitalization
FMCG-2	Consumer goods	Before 1950	10.000 - 50.000	Project Manager Marketing & Technology
INSUR-1	Insurance	Before 1950	>100.000	Head of COO Office / Functional Lead Change

Table 14: Summary of firms and respondents in the data collection (continued)

Firm	Industry	Founded in year	# of employees	Interviewee position
LOGI-1	Logistics	1976 - 2000	>100.000	SVP Transformation / Global Sourcing
LOGI-2	Transport / Logistics	1976 - 2000	>100.000	Head of Digitalization & Technology
MEDIA-1	Media	After 2000	1.000 - 10.000	Head of Innovation
PHAR-1	Pharmaceuticals	After 2000	>100.000	Head of Financial Reporting and Planning (incl. Digitaliz.)
PHAR-2	Pharmaceuticals	Before 1950	50.000 - 100.000	Project Lead – Portfolio & Innovation Management
RETAIL-1	Retail	Before 1950	1.000 - 10.000	Head of E-Commerce
SOFT-1	Software	After 2000	1.000 - 10.000	Unit Owner
TELE-1	Telecommunications	1976 - 2000	<1.000	Head of Corporate Communication
TELE-2	Telecommunications	1976 - 2000	50.000 - 100.000	Assistant to the Managing Director

4.3.3 Data analysis

To analyze our data, we relied on an iterative process. Following the principles of grounded theory to code our data, we consistently alternated between the collected verbal accounts and the emerging theoretical concepts (Corbin & Strauss, 2015; Glaser & Strauss, 1967). Throughout this process, the qualitative research software ATLAS.ti aided in systematically documenting, coding, and analyzing our interview data. This analysis included an in-depth assessment of individual cases as well as a cross-case comparison across the entirety of cases (Yin, 2009). Three distinct phases characterize this analytical process, reflecting the methodology of Gioia et al. (2013). An overview of all phases is provided in Figure 1.

Phase I: Identification of first-order themes

In the first analytic phase, we followed an open coding procedure and attached first-order codes to the original pieces of evidence (Strauss & Corbin, 1998). The codes describe emerging empirical themes in the data. More specifically, we first identified salient themes regarding the role of top managers in firms' digital transformation in each interview transcript. Along this process, we began to compare the separate themes with those from the other transcripts, searching for possible commonalities and inconsistencies across all cases. As a result, we re-evaluated the themes and re-coded the separate pieces of evidence in order to eventually condense them into a representative and refined set of empirical themes.

Phase II: Constructing second-order conceptual categories

In the second phase, we summarized the empirical themes in clusters of higher-order (Strauss & Corbin, 1998). The resultant structure represents the thematic framework that defines the indications for involvement and practices of top managers in firms' digital transformation. Using the same approach, we further consolidated these themes into conceptual categories that may "help us describe and explain the phenomena we are observing" (Gioia et al., 2013, p.20). For instance, after having carefully examined interviewees' statements about corporate culture, we clustered the themes '*promoting a firm culture of learning and openness for mistakes*', '*reassuring employees about their job perspectives*' and '*investing in digital training offerings tailored to employees' individual needs*' into the conceptual category '*building trust and commitment*'.

Phase III: Condensing into the aggregate dimensions

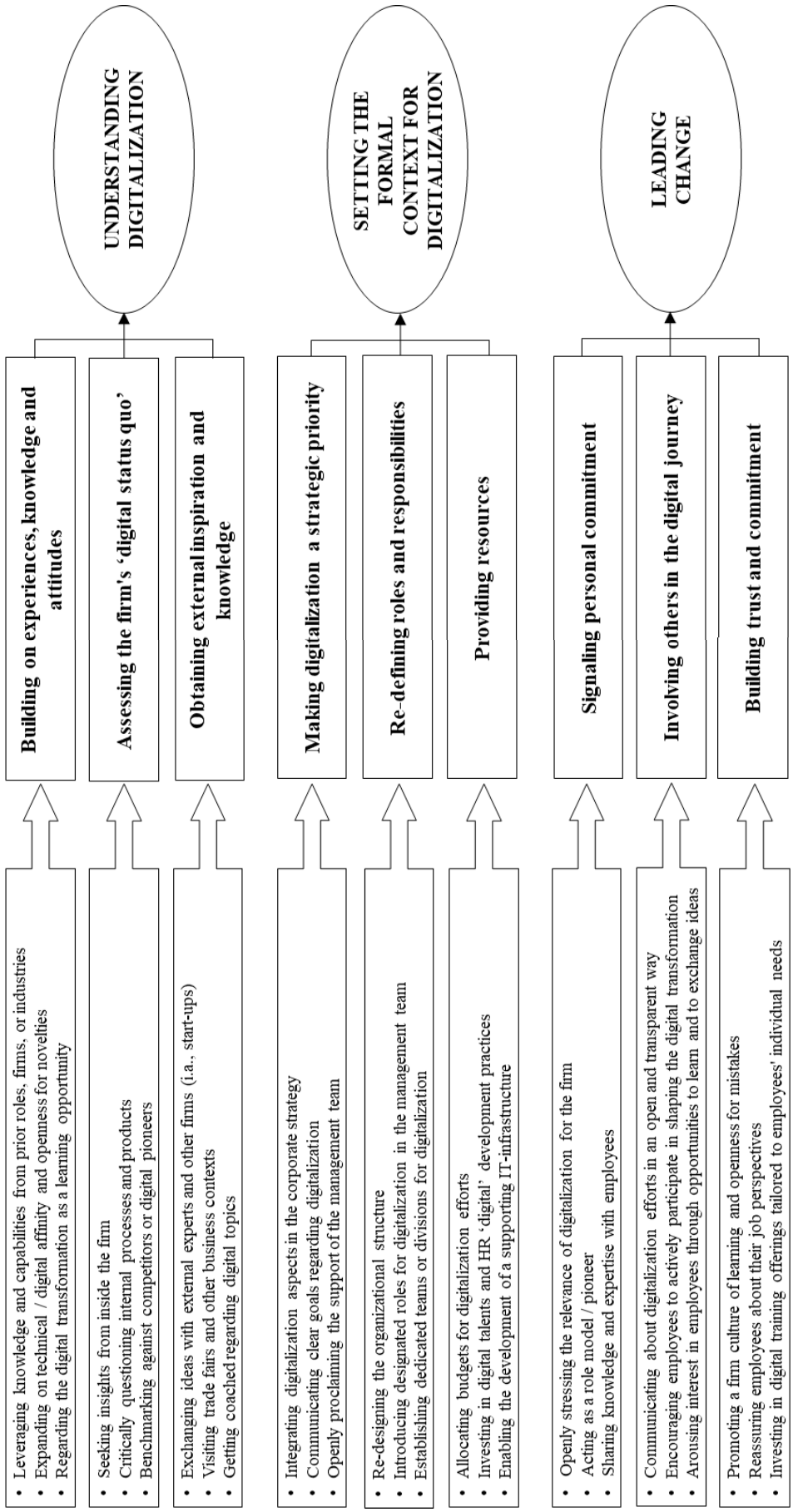
In the third phase of the analysis, we further condensed the conceptual categories into aggregate dimensions. The dimensions build the core of the resultant empirically grounded

theoretical framework, which specifies and reflects the three distinct involvement indicators of top managers in firms' digital transformations. Throughout this process, we verified the fit of our theoretical framework by continuously going back to the original quotes and revising the emerging theoretical themes.

4.4 Findings

Our thematic analysis served as the basis for obtaining a better understanding of the role of top managers in firms' digital transformation. Figure 1 shows the resultant data structure, which reveals three key actions emanating from top managers as a response to their firm's digital transformation. We labeled these key actions '*understanding digitalization*', '*setting the formal context for digitalization*', and '*leading change*'.

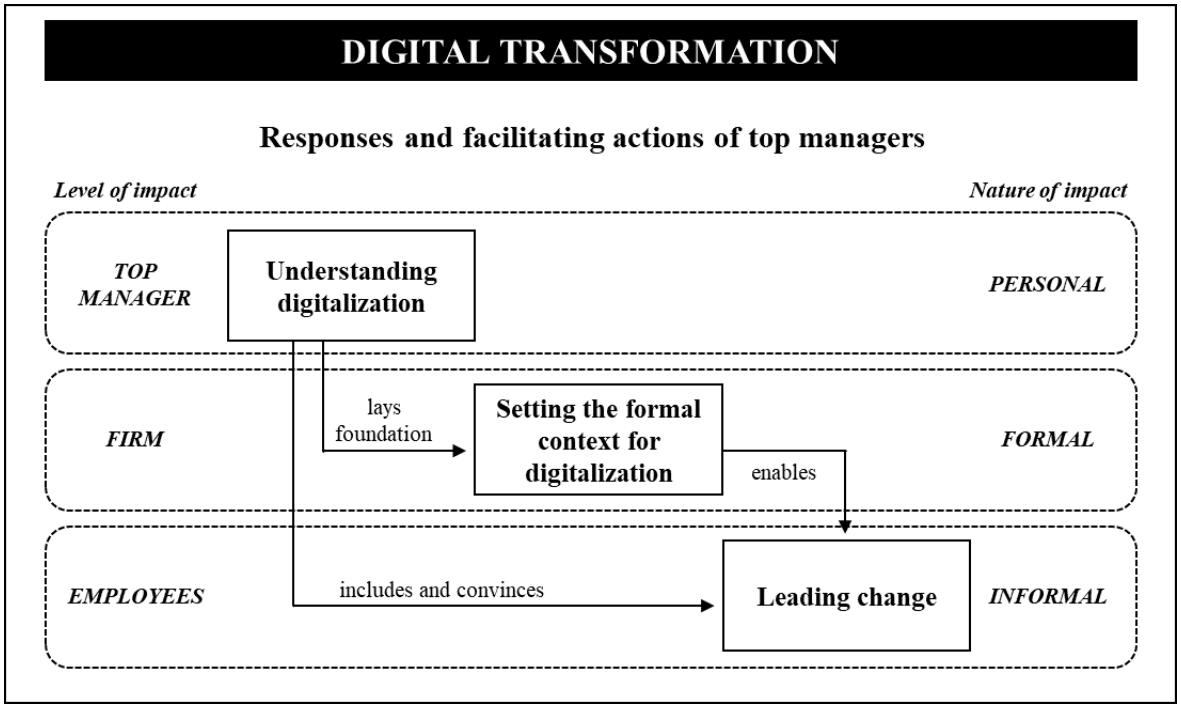
Figure 1: Actions of top managers as a response to the digital transformation



Source: Own illustration

Our analysis of the collected evidence reveals that top managers' practices in response to the digital transformation are particularly discernible in the organization at three different levels: top manager-level, firm-level, and employee-level (see Figure 2). Respectively, the corresponding impact emanating from top managers is personal (i.e., individual understanding), formal (i.e., organizational structure and processes) and informal (i.e., communication and persuasion) in nature. Overall, the three levels reflect the sequence based on which decisions in response to the digital transformation are formed at the top management level and gradually take effect throughout the entire firm.

Figure 2: A model of top managers' practices to promote the digital transformation



Source: Own illustration

The distinct actions of top managers are explained in detail below. Representative interview quotes enrich this discussion and lend empirical support for our interpretations. Additionally, in Table 15, we show primary data excerpts, which reinforce our explanations of the three key themes and provide empirical grounding for the conceptual categories in our theoretical framework.

Table 15: Data supporting the interpretation of second-order themes

Aggregate dimension	Conceptual categories	Exemplary quotes
Understanding digitalization	*Building on experiences, knowledge and attitudes*	We built a digitalization department... At first glance, it seems to work out really well, because the position of the boss was not filled by an internal person, but by a relatively illustrious person with lots of experience in the digitalization field. That is a renowned manager, who previously filled a similar position at IBM. (AUTO-1)
		Relating to Person XY, it is very interesting because he has never been a technician, he is an economist... He acquired his understanding about digital topics just out of enjoyment and curiosity. (TELE-1)
		We got Person XY in the management team, who is responsible for digital topics. Since he comes from this field and has his background in there, he can describe and communicate things with a high level of authenticity. (AVIA-1)
		Our CEO is very open by mentioning in every internal speech: 'I need to learn every day. Especially the digital transformation is completely new to me. The newly arising technology has never been there before. This means that I need to spend some time to understand what we need to do.' (CHEM-2)
	Assessing the firm's digital status quo'	Digitalization has become a firm part of our firm strategy and we strive to be the leader in our industry with regard to digitalization. (LOGI-1)
		One needs to think customer-centric. And for me the customer are also the employees, so I need to see how to get close to them... So we went into the production for 24 hours - early/late/night shift. We talked to the people and obtained a lot of input. (CHEM-2)
		Very inspiring are the American firms. Be it Amazon, Salesforce, etc. Those are firms that provide the possibility for orientation, to look what their corporate culture is like, what the set-up of the firm is, and what can we do ourselves, what can our firm learn from them. (AUTO-2)

Table 15: Data supporting the interpretation of second-order themes (continued)

	He is very self-critical and asks a lot of critical questions. He is nobody, who says, "We have always done it this way", the classic. He is a person, who constantly questions things and also does not hesitate to frequently restructure. (AUTO-4)
Obtaining external inspiration and knowledge	If you have been in the digitalization field for quite some time... then you have built up a network to others - executives of other firms or the CIOs of other firms - where regular exchange occurs. (AUTO-2)
	We are members of the association XY, in which firms exchange ideas. There are lectures, events, exchange platforms. The association XY pushes the topic of digitalization very strongly. (ENGI-1)
	My boss frequently visits the Silicon Valley to obtain inspiration and knowledge. He takes a look at the newest technologies. In addition, he visits lectures at universities and listens to expert talk there. He talks with start-up people, with people who work for large tech companies. And this is not only what he does, but also all other top managers, including our CEO. (TELE-2)
	The car trade show is currently ongoing in Düsseldorf. I will go there after our conversation. There is also a partner of me, who will stand on our stage. He has founded the probably most progressive AI firm in the Silicon Valley. And we are doing product development with him now. (CHEM-1)
	Of course, there are web trainings, but our executives also receive real 'classroom trainings' where they are familiarized with certain topics and also obtain practical tools regarding how to deal with the fears and concerns that come along with the digital transformation. So really practical assistance. (LOGI-1)

Table 15: Data supporting the interpretation of second-order themes (continued)

Setting the formal context for digitalization	*Making digitalization a strategic priority*	We clearly integrated the topic digitalization in our strategy, which all executives jointly revise every five years... There is a very clear commitment from the executive board. (AUTO-4)
		The digital strategy, which we just released, actually writes the red thread through our group strategy. (LOGI-2)
		As of this year, the topic digitalization truly arrived in the corporate strategy. And in this context, it was raised to the very highest level of the agenda. (FMCG-2)
		Every quarter, we have at least one employee event for our division... Last summer, it was the clear statement of my boss to set the goal that 'All printers will be removed.' (AUTO-2)
	Re-defining roles and responsibilities	We went down from 6, 7 hierarchies down to 2, 3, which is simply inevitable. If you want to act fast, you need less votes, short ways and flat hierarchies. (SOFT-1)
		There definitely is a lot of movement noticeable - away from the classical hierarchies, away from the classical departments and divisions, more toward agile, flexible teams. (TELE-1)
		The chairman of the management board initiated the recruitment of the Chief Digital Officer (CDO). (AUTO-3)
		The CDO is really the heart of the digital transformation. He is the push to the executive board, again and again, to keep the topic on the agenda. He administers and pushes the investments in this topic. (FMCG-2)

Table 15: Data supporting the interpretation of second-order themes (continued)

	Providing resources	In our firm, the commitment is so large that the CEO announced already that we will invest approximately 2 billion dollars into the digital transformation. This is, of course, a large commitment. (LOGI-1)
		We have various internal funding mechanisms, so that we explicitly put a certain amount of money aside for digitalization efforts. That is a considerable amount, based on which distinct digitalization initiatives can be fostered more quickly than it would be the case for the regular formal process in our firm. (AVIA-1)
		We centrally educate digital trainees, who, with some kind of 'street ability', are deployed all over the corporation. (LOGI-2)
		We expanded in many IT divisions internally, that is with regard to human resources. As part of this process, we also try, of course, through some kind of 'employee transformation' to develop employees away from divisions, where old technologies gradually die off. (AUTO-1)
		We have developed a platform, on which you can find all information, digitally stored, with video material, podcasts, etc. (TELE-2)
Leading change	*Signaling personal commitment*	Especially our CDO absolutely passionately emphasizes the topic again and again and again, and he is absolutely enthusiastic about moving the topic forward. (FMCG-2)
		We as management team need to live the topic every day. Otherwise, the transition is too stark for the organization. The people would not believe in it, they would quickly loose courage to assume responsibility oneself. (SOFT-1)

Table 15: Data supporting the interpretation of second-order themes (continued)

	Our executive board members has an influencer account on LinkedIn and she is very mindful about bringing specific topics into the discussion. (LOGI-2)
	He regards himself and the IT department as the spearhead of the digital transformation. In fact, he said (regarding the removal of printers from offices) 'we will exemplify this, we will do this now, we will do this as a pilot project. (AUTO-2)
Involving others in the digital journey	Change always means a dramatic necessity to communicate. Among many others, we do so-called 'digital mornings', for which we invite people from the digital world. (CHEM-2)
	We give away employee awards with specific award categories that shall honor digital ideas. (BANK-2)
	You need to create the context in order to excite people, especially young talents. You need to create the working environment, where all this (i.e., digitalization) is lived. (SOFT-1)
	In certain parts of the production, we have run trials to shift toward a paperless production. This means that the employee only uses a large monitor and a tablet. In this context, we collaborated very intensively with them. We conducted interviews with the colleagues in the production, asking 'what would be useful for them'. I believe it is a good way to involve the employees early on... because the employee close to the process truly knows how the process actually functions... Involving people, creating this together with them, is essential in my opinion. Then one also wins their commitment, then people join in early on. (ENGI-1)

Table 15: Data supporting the interpretation of second-order themes (continued)

	Digital transformation can only work out, if the employees are taken along.... This means, of course in terms of the employee communication... for instance, that Mr. X already started setting up large formats many years ago. We call it 'digital sessions'... These are 90 minutes and interested colleagues from all over the world come together in Munich or join the session via a livestreamed web conference... Logically, our various executives also communicate about these topics on all kinds of channels - both internal and external ones. (INSUR-1)
Building trust and commitment	You can sense that he is absolutely enthusiastic about the topic and that he trusts his people. Once he has the confidence in you, he will fully support you, no matter what you do. That is indeed pretty cool; you can learn a lot... If someone has an awesome idea, then he/she will get funding for it and full support, no matter which level on the hierarchy that person is. Honestly, that is very, very inspiring. (FMCG-2)
	For colleagues, who prefer a different mode of learning, we also have a global partnership with LinkedIn. This means that every employee, intern, student assistant or executive can compile his or her individual digital learning paths. (INSUR-1)
	The sentence that struck me most recently was in a conversation with our CEO about the digital transformation. He said, 'Well, we shouldn't forget that throughout the organization we have some kind of cross section. And we need to find a solution for all employees. (AUTO-1)
	The impact on our employees is that we say, 'the job you do today will not be there anymore tomorrow'. This is what unsettles people initially, they are afraid of change. Everyone has that... What we do is a 'cultural change project', which runs over several years and through which, in the first place, we make our employees understand where their strengths lie. (AUTO-5)

Overall, our data underlines that firms are aware of the opportunities and challenges of the digital transformation. Since digital transformation is a new phenomenon and entails significant levels of uncertainty, the strategic responses by the firms in our sample reflect a somewhat cautious approach. In fact, the digital transformation concept is hard to grasp, as mirrored in the general questions raised by the firms: 'What does the digital transformation mean for the firm?' and 'How to respond to it?'. Insecurities related to the digital transformation's actual meaning, scope, and effects are also reflected in the lack of a unified definition or description. What many respondents consistently explained, though, is that digitalization occurs on two distinct levels: 1) product (i.e., customer-driven responses), and 2) internal processes (including administration and production). Another important insight is that the commitment and support from the TMT are indispensable to enforce and realize digitalization efforts throughout the firm. In the following, the distinct practices of top managers in response to the digital transformation are explained:

Understanding digitalization

Understanding digitalization reflects top managers' approach to obtain a deeper understanding of the opportunities and challenges that the digital transformation entails as well as the role of firms therein. Since the digital transformation is a novel phenomenon, it is not possible to rely on an established set of common knowledge and a long history of tested approaches (Earley, 2014). Consequently, top managers first need to make sense of the phenomenon themselves in order to develop targeted actions and responses that prepare their firm for the challenges posed in this dynamic environment (Gioia & Chittipeddi, 1991; Weick, Sutcliffe, & Obstfeld, 2005). Our analysis shows that top managers inform and educate themselves regarding the digital transformation by building on the following practices: *building on experiences, knowledge and attitudes; assessing the firm's 'digital status quo';* and *obtaining external inspiration and knowledge*.

As regards the *building on experiences, knowledge and attitudes*, top managers expand on various personal and external factors that help them to obtain a deeper understanding of the digital transformation and its impact on the firm. Our data shows that top managers' existing knowledge base and experiences from prior roles, firms, or industries help them to make sense of the digital transformation and derive targeted conclusions. This finding aligns with upper echelons theory, which suggests that prior personal and professional experiences, as well as knowledge fundamentally shape top managers' perceptions and subsequent strategic choices (Hambrick, 2007; Hambrick & Mason, 1984). Our respondents regarded a professional background in the digitalization field or prior experiences with change processes as

particularly helpful, as these backgrounds provide top managers with the necessary intellectual foundation and capabilities to accurately assess the situation, to decide on appropriate measures, and "to communicate these (to the workforce) (…) with a high level of authenticity" (AVIA-1). While existing knowledge serves as a steady basis for top managers to build on, many respondents also emphasized the role of top managers' drive and attitude as a critical driver of firms' digitalization efforts. Top managers' affinity for the topic and curiosity push him/her to grow the existing knowledge base and to seek new insights about recent technologies and opportunities. A desire to learn about these new topics reinforces this ambition, as described by this interviewee:

> One can sense my boss's pure lifeblood and absolute passion for the topic of digitalization. And also the topic of lifelong learning, to permanently deal with this topic and to permanently call for the topic to be moved forward, to push it, and to not lag behind. (AUTO-2)

In order to obtain a more fine-grained understanding of digitalization, top managers also look inside their firm and critically *assess the firm's 'digital status-quo'*. This internal reflection is an essential activity, as the shift toward digital often requires fundamental changes to an incumbent's established business model and thus a deviation from the status-quo (Teece, 2010; Verhoef et al., 2019). In our data, we observe that top managers actively seek insights not only from digitalization experts within their firm but also from individuals familiar with and deeply involved in the processes and business areas affected by the digital transformation. As part of this overall assessment, top managers also rely on benchmarks internal (e.g., inter-departmental comparisons) and external to their firm. External points of reference include digital pioneers (e.g., digital start-ups and other leading, more established firms) and regular partner firms. Related research suggests that competitive benchmarking is essential to achieve superior performance (Shetty, 1993).

Finally, our evidence shows that top managers strive to *obtain external inspiration and knowledge*. Related research has indicated that external advice seeking enhances exploratory innovation in firms, as it helps TMTs to expand organizational boundaries, to acquire new knowledge and to shape their recognition of opportunities in the external environment (Alexiev, Jansen, Van Den Bosch, & Volberda, 2010; Kaplan, 2003). According to various sample respondents, consultancies and specialized coaches formally train top managers regarding digitalization topics and provide them with insights about the current digital landscape. Sometimes, top managers also listen to lectures at leading universities or visit trade fairs. Furthermore, top managers learn about other firms' digitalization approaches through

internal firm events with digitally progressive firms. Another significant source of inspiration is the personal exchange with various kinds of people, such as other firms' executives with similar roles, digitalization experts from large tech companies, or start-up members. Different geographic contexts – primarily innovation hubs like Silicon Valley, Tel Aviv, or Shenzhen – were also mentioned as particularly attractive places for this exchange to occur. The following quotation underlines this notion:

> [Our top managers] regularly fly to (…) other countries or cities that extremely push the topic [of digitalization], that are very advanced and that have vast knowledge about it. (TELE-2)

Setting the formal context for digitalization

Setting the formal context for digitalization relates to the formal organizational structures, processes, and resources put in place to enable the digital transformation to unfold. According to prior research, flexible organizational structures encompassing independent business units separated from the headquarters, agile organizational forms, and digital functional areas are particularly favored for firms' digital transformation (Sklyar, Kowalkowski, Tronvoll, & Sörhammar, 2019; Verhoef et al., 2019). Our data suggests that top managers set the formal context for digitalization by *making digitalization a strategic priority, re-defining roles and responsibilities,* and *providing resources*.

Throughout our interview process, respondents emphasized that digital transformation is essential to remain competitive. By *making digitalization a strategic priority*, which was the case for the vast majority of our interviewed firms, the TMT lays an essential foundation for the future, and specifically for all subsequent digitalization efforts. A necessary action here is the integration of digitalization aspects in the firms' general strategies. Hess et al. (2016) highlight the value creation benefits of a separate digital transformation strategy, which "coordinates the many independent threads of digital transformation and helps [firms] navigate the complexity and ambiguity of identifying their own digital 'sweet spots'" (p.125). According to our data, firm strategies increasingly include digitalization aspects – a phenomenon that is especially observable in firms where the TMT revised and approved the firm strategies only recently. Many interviewees also report that digitalization now even represents "a major building block" (AUTO-4) in their firm's corporate strategy. By openly stressing the relevance and role of the digital transformation for the firm and by continually mentioning the topic across various communication channels, top managers testify its strategic importance, as explained by the CDO of a large chemicals firm:

> We have a very visionary CEO, who made the digitalization his subject, who often stands with me on stage, who, over the past two years, never missed mentioning the word 'digitalization' in his internal presentations and speeches. (CHEM-2)

In addition to *making digitalization a strategic priority*, our analysis reveals that top managers *re-define roles and responsibilities* within their firm to pave the way for the digital transformation. This re-definition includes changes to the organizational structure and the introduction of digitalization functions at the individual and team-levels. Prior research suggests that rapid technological progress requires fast responses from firms so that more agile work modes and low levels of hierarchy will be favorable (Eggers & Park, 2018; Verhoef et al., 2019). Many interviewees corroborate this notion by reporting that firms' digital transformation is often accompanied by dramatic changes to the mode of working together. Commonly mentioned terms in this regard were 'new work', flexible and agile. Formally, this transition is perceivable in the organizational structure, as reflected in a general shift toward flatter hierarchies (Schwarzmüller et al., 2018). Furthermore, dedicated roles and entire teams with a specialized digitalization focus are introduced throughout the firm. At the TMT level, many respondents reported that the role of a Chief Digital Officer (CDO) was created "to carry the topic into the firm" (FMCG-1). This finding aligns with Singh and Hess (2017), who highlight the rising establishment of CDO roles in upper echelons and the CDOs' principal responsibility to make digitalization a strategic priority in the firm. Although many firms regard the CDO as a central player in firms' digitalization efforts, other interviewees explained that the introduction of a CDO is only an initial step and impulse toward a broader coverage of the topic; in the long-term, digitalization aspects should be integrated across the entire firm, making the CDO role eventually redundant. Next to dedicated individual functions at the top of the organization, significant adjustments are also perceivable at other organizational levels. For instance, dedicated teams or divisions are often created to foster firms' digitalization efforts. The nature of these entities in terms of size, responsibilities, and people involved differed significantly across our sample. Often top managers are also involved in those bodies:

> We have a specific committee, a dedicated digital board, within which all kinds of decisions with a digital relation are discussed every six weeks and funds are released. Three out of six group management board members are part of this digital board. (AVIA-1)

In addition to these measures, our findings suggest that top managers set the firm's formal context for digitalization by *providing resources* that enable the realization of targeted actions. As one respondent claims, it is the role of the management team "to prioritize [digitalization] topics and correspondingly, to free capacities and resources to drive the digital transformation forward" (LOGI-1). The provided means mentioned relate to financial, human,

and IT resources. Many firms in our sample allocate particular budgets for digitalization initiatives and install various funding mechanisms, which ensures that the necessary funds are readily available when needed (AUTO-1). To match the increased demand of employees knowledgeable about IT and digitalization topics, our sample firms make significant efforts to recruit such individuals. Since the market for digitally skilled personnel is rather small, though, some firms have created entities that specialize in the recruitment and development of this digital workforce. Complementing these efforts, firms also invest in training programs for existing employees, which ensures that employees acquire the essential skills needed in the future. In terms of IT resources, firms invest in a digital infrastructure, which supports the firms' digitalization efforts from a technical standpoint. In particular, firms supply state-of-the-art devices and hardware to employees and invest in software that facilitates the communication and collaboration among the workforce (e.g., Microsoft Teams, Office 365), knowledge storage and exchange (e.g., online platforms that bundle information and other resources), and learning (e.g., online training).

Leading change

Our data analysis further reveals that top managers actively participate in the digital transformation by *leading change*. Since the digital transformation implies significant changes to organizations, but human beings generally "value a sense of coherence, consistency, or continuity over time" (Venus et al., 2019, p.667), employees may perceive it as a threat (Diamond, 1986; Kotter, 1995). Consequently, they tend to resist change processes, which adversely affects the success of intended organizational changes (Bovey & Hede, 2001). In this context, it is a key responsibility of top managers to promote acceptance among employees in order to ultimately win their commitment (Shamir, 1999; Venus et al., 2019; Yukl, 2010). Our respondents reported that top managers lead through the digital transition period and win the support of their employees by *signaling personal commitment, involving others,* and *building trust and commitment*.

In the case of *signaling personal commitment*, top managers show that digitalization is an essential topic for the firm and that they are convinced about the firm's chosen path. Leadership research suggests that leaders' communication of a change vision, which describes the organization in a possible future state within which the organizational identity will endure, is an essential medium to mobilize followers toward change support (Venus et al., 2019; Yukl, 2010). Our data reveals that top managers signal their commitment to the firms' digital transformation by constantly addressing the topic, openly stressing its relevance, and highlighting lighthouse projects in various communication formats, such as "speeches,

employee mailings, (…) internal networking occasions, (…) etc." (TELE-2). Top managers also testify their commitment to the digital transformation by persistently pushing the topic despite obstacles or other's skepticism (FMCG-2), and by acting as a role model or pioneer. A representative indication for this behavior is the sharing of knowledge and expertise with employees, as described in the following quotation:

> As soon as he talks with somebody and they get to a certain topic, one can truly sense the fire in his eyes. (…) He immediately begins to show or explain people certain things or does a follow-up. (AUTO-2)

Furthermore, we observe that top managers make explicit attempts to *involve others* in the firm's digital transformation. Since digital transformation means massive changes for firms and their employees, many interviewees stressed the urgent need for open and transparent communication. According to prior research, regular credible communication in both words and deeds is essential in change processes, as it eases employees' perceptions of change, reduces resistance, and fosters their commitment (Christensen, 2014; Kotter, 1995; Schulz-Knappe, Koch, & Beckert, 2019). Besides, our analysis shows that top managers try to arouse interest in digitalization topics among the workforce and to encourage their active participation. For example, one respondent described that the TMT offers digitalization experts and departments the responsibility, budget, and freedom to unfold their know-how and develop solutions themselves. This "is a very attractive context (for the digital transformation) and increases the probability of success for (ideas and solutions) to be implemented" (ENGI-1). Another popular practice is top managers' active encouragement for employees to express their digital ideas as well as special awards that honor this commitment. Our data also uncovers that top managers try to create excitement and win the commitment of their co-workers by offering a range of events (e.g., start-up pitches and expert talks), networking (e.g., roundtables and social communities) or learning opportunities (e.g., digital learning platforms and workshops).

Given that change processes usually entail uncertainty and fears, our evidence emphasized that top managers strive to confront this challenge by *building trust and commitment* among the workforce. Scholars suggest that trust in leaders fosters employees' openness and readiness for corporate change processes (Rafferty & Simons, 2006; Stouten, Rousseau, & Cremer, 2018). Additionally, trust enhances leaders' credibility when communicating the reasons for the proposed organizational changes, which in turn facilitates employees' acceptance and support thereof (Rousseau & Tijoriwala, 1999). In our interviews, we observed various actions of top managers that reflect efforts to build trust and commitment. For

instance, top managers promote a firm culture that fosters learning and in which "nobody has to be afraid of making a mistake" (AUTO-4). Since the digital transformation will render many existing jobs obsolete in the future, top managers try to remove these fears by reassuring employees about their job perspectives. Not only are top managers aware of this changing reality, but also try to address this challenge by openly communicating with the workforce (AUTO-5) and by "searching for a solution for all employees" (AUTO-1). For example, respondents reported about investments in training offerings that cater to the employees' individual needs and preferences, and that foster their digital competences (e.g., FMCG-1). In this way, employees acquire essential skills and knowledge that will be increasingly demanded along the firm's digital transformation process. Consequently, this training will ensure the employees' qualification for jobs that will eventually replace the current ones. The following quote sums up this overall notion:

> The digital transformation requires a high level of authenticity. (…) The most decisive factor is not technology but change management. Taking people by the hand, taking away their fears, convincing them that digitalization will extremely change and transform our working world. But of course, new jobs will emerge. (LOGI-1)

4.5 Discussion

The digital revolution has a fundamental impact on the way in which business is done. To remain effective and competitive in the long-term, firms have to respond to these changing dynamics and pave the way for digitalization efforts to unfold. Top managers assume a particularly important role therein, because they are the key decision-makers in firms and set the firms' strategic direction (Finkelstein & Hambrick, 1996). Despite the growing awareness of the topic in practice, digitalization topics have rarely been touched in the academic literature about top managers. To address this gap and to obtain an empirically grounded understanding about this important topic, our study explores the particular role assumed by top managers in firms' digital transformation processes. To this end, a thematic analysis of the collected evidence sheds light on the specific responsibilities, decisions, and actions top managers carry out to facilitate digitalization efforts in their firms. Our results reveal that top managers respond to the challenges posed by the digital revolution in three distinct ways: *understanding digitalization*, *setting the formal context for digitalization*, and *leading change*. The resultant framework theoretically substantiates the role of top managers in firms' digital transformation processes and delineates the specific practices through which top managers enable the digitalization efforts to evolve across the organization. After having identified and assessed the implications of the digital revolution for the respective firm, top managers take action and integrate the entire organization through formal and informal measures.

4.5.1 Implications for theory

Our empirical analysis and resultant framework contribute toward a more fine-grained theoretical understanding about top managers and firms in the digital age in various ways. First, our study contributes to digitalization research by examining the role of top managers in large firms' digital transformation. Although the scholarly interest in digitalization topics has been growing across various business research streams, the role of top managers has been widely neglected yet. Whereas prior academic studies mostly focus on objects such as the antecedents and consequences of digital business models, digital technologies, or e-commerce (Verhoef et al., 2019), our study places the individual at the center of our analysis. By investigating the micro-level practices of top managers, this study not only responds to consistent calls for further research on digitalization aspects (e.g., Verhoef et al., 2019) but also offers detailed insights about the internal procedures in large German firms. Additionally, it extends prior research that acknowledges the significant role of top managers in firms' digital transformation processes (e.g., Cortellazzo et al., 2019; Matt et al., 2015) and re-emphasizes top managers' relevance and wide-reaching organizational impact therein. Our empirically grounded framework reflects this notion and provides a systematic overview of specific roles, decisions, and actions pursued by top managers to facilitate firms' digitalization efforts. This way, it serves as a solid theoretical basis for subsequent digitalization research.

Second, our study also provides essential insights to top management research. By investigating the question '*how do top managers deal with the digital transformation?*', we are among the first studies that directly associates top managers with digitalization aspects. Consequently, our collected evidence offers valuable initial insights about top managers' digitalization-specific roles, decisions, and actions. In particular, the data underlines that top managers play a key role in firms' digital transformation as they facilitate the necessary establishment of an organizational structure and culture that jointly embrace the challenges and opportunities underlying this significant period of change. The resultant framework derives relevant implications for research fields that strive for a deeper understanding of top managers in firms.

Specifically, our framework contributes valuable insights to research building on upper echelons theory (Hambrick & Mason, 1984), because digitalization aspects were touched upon within this field only rarely. By delineating the impact of top managers on various digitalization decisions and outcomes across the firm, the framework points out numerous possible avenues for further upper echelons research. Upper echelons scholars may take these insights as a basis and dive deeper into certain aspects by linking top managers' characteristics

(e.g., demographic characteristics, personality traits, or experiences) with digitalization choices and/or subsequent digital performance measures. In general, our study supports the basic tenet of upper echelons theory as it reveals that top managers build on prior experiences, knowledge, and attitudes to make sense of the digitalization phenomenon. Especially top managers' digital affinity, openness for novelties and prior professional experience with digitalization topics appear particularly favorable for moving firms' digital transformation forward. Next to contributing novel insights, this study also adds value from a methodological standpoint. In fact, qualitative methods to examine top managers in firms are – despite several encouragements (e.g., Nielsen, 2010; Priem, Lyon, & Dess, 1999) – rather rare in this research field. By choosing a qualitative research design, this study establishes an empirical basis for theorizing the digital transformation phenomenon within the upper echelons tradition. To obtain an even more fine-grained understanding of the aspects and links suggested in our framework, quantitative approaches may serve as a useful complement.

Our study also contributes valuable insights to leadership literature. Specifically, the third dimension of our framework '*leading change*' depicts leadership behaviors that act favorably in the digital transformation context, i.e. *signaling personal commitment*, *involving others in the digital journey*, and *building trust and commitment*. Altogether, these aspects emphasize the human element in the digital transformation, which may be perceived as a threat by the workforce. Our findings underline the importance of leadership in this transition period. It is the responsibility of leaders to build an organizational culture in which change is embraced, and everyone feels included, supported, as well as enabled. By strengthening interpersonal relationships and knowledge exchange, creating excitement about digitalization topics among the workforce and investing in employee development, top managers will be able to win the organization's necessary commitment to master the digital transformation. Formally, these attributes align with the participatory and relationship-oriented leadership styles, which Schwarzmüller et al. (2018) propose to be increasingly important in the digital age.

Third, our study results illustrate the multifaceted nature of top managers' role in firms' digital transformation processes. The impact of digital transformation is perceivable at different levels and in distinct ways. Top managers first (need to) develop a deep understanding about digitalization topics and the implications for the firm themselves, before making choices that affect the organization in both formal (i.e., organizational design) and informal (i.e., organizational culture and relationships) ways. The level of detail presented in our framework mirrors the phenomenon's multidimensionality, highlighting the complexity faced by firms and their top managers when dealing with the digital transformation. For instance, as

comprehensively discussed within the strategic management and organization literature, top managers are constantly challenged with managing strategic contradictions, such as balancing exploratory and exploitative firm activities, to sustain their organization's performance (March, 1991; Smith & Tushman, 2005). The digital transformation presents another exemplary case in which this paradox applies, as the rapidly evolving digital environment requires firms to adapt and integrate digitalization aspects into their existing business. Our framework provides several initial insights about how top managers of large incumbents deal with these contradictions.

Finally, our framework accentuates the multiplicity of research opportunities within and across various scientific disciplines. Whereas several scholars noted that digital transformation research is highly fragmented and mostly occurs within separate research fields (Schwarzmüller et al., 2018; Verhoef et al., 2019), the framework shows the diverse digital touchpoints top managers have across the firm. Hence, it underlines the need for further research that reaches beyond single disciplines and integrates insights from multiple thematic directions (e.g., innovation, leadership, or corporate governance).

4.5.2 Implications for practice

Our study also provides valuable insights and recommendations for practice. First, the analysis of our data provides ample evidence that top managers play a decisive role in the digital transformation. Top managers identify the phenomenon's implications for the firm, define the firm's strategic direction and provide the context within which digitalization efforts may unfold. Although the TMT is not the only party in the firm that advances the digital transformation, and digitalization efforts should ultimately be integrated across the entire organization, our findings emphasize that the commitment at the top is essential for its realization and rapid rollout. While the digital transformation involves uncertainty and requires firms to develop novel responses to this unprecedented change, our framework presents numerous micro-level practices employed by top managers of some of Germany's leading large firms. Hence, it may serve as a guidepost for top managers seeking insights on tried and tested digital transformation approaches for their firms.

Second, our data reveals that top managers need to set the context that enables the workforce to become actively involved in the movement and push digitalization forward. A first step in this direction is the prioritization of the firms' digital transformation and the integration of the topic in the firm's strategies. Dedicated digitalization functions within the TMT and across the entire firm (e.g., CDO or digitalization committees) may accompany this initiative. The

provision of financial, human, and IT resources further fuels digitalization efforts. Besides, our study supports prior research that emphasizes the advantages of moving toward more agile organizational structures and flatter hierarchies, as these enable a fast information exchange and quick responsiveness to today's rapidly changing environment (e.g., Schwarzmüller et al., 2018).

Third, our evidence indicates that the most significant digitalization enabler is a firm-wide mindset shift. Since the digital transformation of firms is an enormous undertaking, it requires the input and commitment of the entire organization. Here, top managers assume a key responsibility in facilitating the organization's mindset shift through effective leadership. Since the digital transformation entails uncertainty and may evoke fears among the workforce, it is essential to 'take the employees by the hand', understand and take their fears, and to strive for a solution that fits all. Our data suggest that a mindset shift is facilitated by involving employees early on and giving them the freedom and encouragement to participate in actively shaping the firm's digital transformation.

4.5.3 Limitations and future research

Our inductive study is subject to several limitations. First, our analysis is based on the verbal accounts of top managers and close associates in large German firms. Due to our purposive sampling logic and the relatively small sample size, the generalization of our findings to other contexts is somewhat restricted. Other contexts, such as different cultural contexts (e.g., cultures scoring lower on uncertainty avoidance than Germany) and younger firms with less established structures (e.g., start-ups), may provide valuable complementary insights about top managers in the digital age. Second, the evidence about the practices of top managers is based on the interview responses of single individuals and thus may not be representative of all digitalization efforts in their firm. To enhance objectivity and obtain an even deeper understanding of the approaches and initiatives toward digitalization, it would be useful to extend the analysis by interviewing multiple individuals in the firm. In particular, interviews with individuals from different hierarchical levels, functional areas, or with dissimilar responsibilities might offer promising insights. Other sources of information, such as firms' annual reports or excerpts from top managers' internal communications might enrich this analysis as well. Finally, given the scarcity of research associating top managers with firms' digital transformation, our research aims to generate an initial understanding of underlying roles, responsibilities, and actions. Consequently, the scope of this study is very broad. Based on our theoretical framework, we encourage further research that employs a narrower scope and contributes more fine-grained insights about the framework's distinct elements.

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